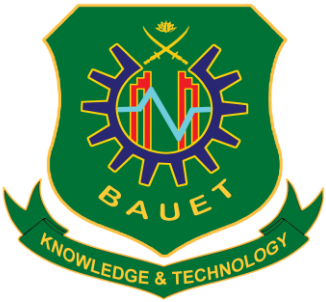
Bangladesh Army University of Engineering & Technology (BAUET)



Department of Computer Science and Engineering (CSE)

Syllabus for
Bachelor of Science (B.Sc.)
in Computer Science and Engineering (CSE)

Applicable for Session 2019-20 and onward

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Preface to Second Edition

Bangladesh Army University of Engineering & Technology (BAUET) offers undergraduate programs in the faculty of Electrical and Computer Engineering (ECE). This syllabus is for the undergraduate students in the Department of Computer Science and Engineering (CSE) of BAUET. Although this syllabus has been written mainly for the students, course coordinators and teachers will find it valuable as a reference document. Also, anybody who desires to know about the course contents of CSE Department will find this syllabus helpful.

Department of Computer Science and Engineering has started its journey from academic session 2014-2015. With its excellent professional competence, pragmatic curricular, expert teaching view points and capabilities of training will achieve an excellent grade. The department of CSE has smart class rooms, modern laboratories with interactive boards (Software Engineering Lab, Network Lab, Operating System Lab, Microprocessor and Microcontroller Lab, Computer Graphics Lab, Database Lab, DLD Lab and Mobile Game and Apps Testing Lab, Sheikh Russel Digital Lab etc.) to learn and practice. This department will produce highly qualified and skilled computer engineers. Over the years, this rapidly provides the leadership skills to the undergraduate students who will prove their potentiality at home and abroad. Our curricula, faculty and research areas focus on an array of topics including Hardware, Software, Networking and Communication, Bioinformatics, Database and Data Mining, Privacy and Cryptography, Computer Graphics & Digital Signal Processing, Algorithm and Complexity, Mobile Computing, Artificial Intelligence & Robotics, System Analysis Design & Development. Students considering majoring in CSE should have shown considerable ability in mathematics and logical reasoning. In view of that a number of courses on mathematics and basic science have been felt mandatory to be included in the syllabus. In addition to some Social Science, Management, Accounting, Economies and Communication skills development related classes have been incorporated to make the syllabus a balanced and reasonably complete one.

The CSE program of BAUET approved by UGC, presently follow the Outcome Based Education (OBE) curriculum for conducting courses. Consequently, Integrated Design Project, which is one of OBE's salient features, has been introduced from 2019-2020 sessions in all corresponding undergraduate batches.

According to the policy of BAUET, the syllabus is revised minimum once in every three years. Some of the information recorded in this syllabus is likely to be modified from time to time. Everybody concerned is strongly advised to be in touch with the advisers or the undersigned regarding modifications to be introduced later. It is hoped that this syllabus will be of much use to everybody concerned.

Mohammed Golam Sarwar Bhuyan
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Qadirabad,
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TABLE OF CONTENTS

Chapter 1
General Information

1.1 Introduction

Bangladesh Army University of Engineering & Technology, abbreviated as BAUET, started its academic journey on 15 February 2015. It was an outcome of the visionary leadership of the Honorable Prime Minister of the People's Republic of Bangladesh who planned to establish technical universities to be run by the army. The university campus is located near at Qadirabad Cantonment, Natore. All academic programs, courses and syllabus of BAUET are approved by the University Grants Commission of Bangladesh (UGC). All academic programs and examinations are conducted as per the schedule approved by the University.

The B.Sc. Engineering courses in Computer Science and Engineering program shall be offered over a period of four academic years, each of a normal duration of one calendar year. The four academic years shall be designated as 1st Year, 2nd Year, 3rd Year, and 4th Year in succeeding higher years of study. The academic year will be divided into two Semesters (1st Semester and 2nd Semester) having duration of 24 weeks and 28 weeks respectively. Under no circumstances, any student shall be allowed to continue his/her study for B.Sc. Engineering degree for more than six academic years. A student will be required to have 80% attendance of the total number of periods of lectures/tutorials/laboratory classes held during the semester in every course to appear as a regular candidate at that semester final examinations. The courses offered for Computer Science and Engineering department will consist of theoretical, sessional, viva-voce, quizzes/class tests, assignments, presentation, Integrated Design Project (IDP)/Capstone Project and final year project/thesis are of 41 theory courses, 35 sessionals with 161 credits.

1.2 University Vision

The university aspires to transform into a center of excellence in Science, Engineering and Technology programs by providing innovative, multi-disciplinary courses and extensive research facility to the young generation of the country and beyond. It endeavors to make the University a hub of knowledge and be recognized as a leading university of the country.

1.3 University Mission

- To provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology and engineering management.
- To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio- economic development of Bangladesh and global needs.
- To conduct collaborative and research activities with national and international communities for continuous interaction with academia and industry.

- To provide consultancy, advisory and testing services to government, nongovernment, autonomous and individuals for widening practical knowledge and to contribute in sustainable development.

1.4 Vision of the department of Computer Science and Engineering

To create skilled and competent professionals in the field of Computer Science and Engineering with high morals to meet the national and global needs through creative research and innovations.

1.5 Mission of the department of Computer Science and Engineering

Department of CSE is working with the following missions:

i. To provide high quality state of the art education and knowledge in Computer Science and Engineering, to produce competent engineers, capable of solving real-world complex engineering problems to meet the needs of industry and society **(Statement-1)**.
ii. To contribute towards the creation of new knowledge through eminence research and innovation in CSE and allied fields to address emerging national and global issues for well-being of the society (**Statement-2**).
iii. To enable students in attaining required ethics with an attitude of entrepreneurial skills, ethical values and social consciences (**Satement-3**).
iv. To embed leadership qualities amongst the students to follow successful professional career paths and to pursue advanced studies in computer engineering and a life-long learner in cutting edge developments in the field of computing and IT(**Satement-4**).

1.6 Program Educational Objectives (PEOs)

1. Graduates will grow and practice as computing professionals both in industry and government and/or will be able to successfully pursue advanced degrees.
2. Graduates will provide effective solutions to the complex engineering problems related to software and/or hardware by creating, selecting, applying appropriate and modern technologies, skills and tools.
3. Graduates will communicate effectively and work collaboratively maintaining high level of ethical and professional values for improving the society.
4. Graduates will take leadership positions in the industry and also initiate businesses offering innovative technical solutions to national and international problems.

1.7 Program Outcomes

Program Outcomes (POs) represent the knowledge, skills and attitudes the students should have at the end of a four-year engineering program. Based on the suggestion of the Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh, the Bachelor of Computer Science and Engineering (CSE) program will have following learning outcomes:

PO No.	PO statement
PO(a)	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.
PO(b)	**Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4).
PO(c)	**Design/development of solutions:** Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)
PO(d)	**Investigation:** Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO(e)	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6).
PO(f)	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)
PO(g)	**Environment and sustainability:** Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)
PO(h)	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)
PO(i)	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO(j)	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO(k)	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO(l)	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

1.8 Statements and their Relationship/ Mapping with the departmental Mission

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. PEOs are assessable based on the attributes and accomplishments of graduates, preferably those who have worked for 3 to 5 years after graduation. Statements and their relationship/mapping with program mission are presented below.

No.	PEO Statements	Program Missions			
		Statement-1	Statement-2	Statement-3	Statement-4
PEO-1	Graduates will grow and practice as computing professionals both in industry and government and/or will be able to successfully pursue advanced degrees.	Yes	Yes	No	No
PEO-2	Graduates will provide effective solutions to the complex engineering problems related to software and/or hardware by creating, selecting, applying appropriate and modern technologies, skills and tools.	Yes	Yes	No	No
PEO-3	Graduates will communicate effectively and work collaboratively maintaining high level of ethical and professional values for improving the society.	No	No	Yes	Yes
PEO-4	Graduates will take leadership positions in the industry and also initiate businesses offering innovative technical solutions to national and international problems	No	No	Yes	Yes

1.9 Relationship between the POs and PEOs

The relationship between the POs and PEOs in

No.	PO Statement	PEO-1	PEO-2	PEO-3	PEO-4
PO(a)	**Engineering knowledge:** Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.	**Yes**	No	No	No
PO(b)	**Problem Analysis:** Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4).	**Yes**	No	No	No
PO(c)	**Design/development of solutions:** Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)	**Yes**	No	No	No
PO(d)	**Investigation:** Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	**Yes**	No	No	No
PO(e)	**Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6).	No	No	**Yes**	No
PO(f)	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)	No	No	No	**Yes**

PO(g)	**Environment and sustainability:** Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)	No	No	**Yes**	**Yes**
PO(h)	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)	No	**Yes**	No	**Yes**
PO(i)	**Individual work and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.	No	**Yes**	No	No
PO(j)	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	No	No	No	Yes
PO(k)	**Project management and finance:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	No	**Yes**	**Yes**	No
PO(l)	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**Yes**	No	No	No

1.10 Laboratory Facilities of the Department

The department endeavors to provide its faculty members and students adequate laboratory, library and other facilities. Departmental undergraduate courses are well supported by the following laboratories:

Software Engineering Lab: CSE department has a software engineering lab consisting of 39 computers as workstations. With co-located Networking and Operating System lab, class can be conducted for 35 students at a time providing each one PC.

Network Lab: This department has a Network and Internet lab of 38 computers as workstations. All necessary network equipment and accessories are available in the lab for conducting sessional classes for 35 students at a time.

Operating System Lab: The department of CSE has an Operating System lab where sessional classes of different course on Computer Operating System can be conducted. This lab contains 35 computers as workstations for providing cutting edge working environment for the students.

Microprocessor and Microcontroller Lab: This department has a Microprocessor and Microcontroller lab enriched with latest 8086 Microprocessor Trainer Kits along with 8051 Microcontroller Trainer Kits where group projects are conducted.

Computer Graphics Lab: CSE department has a Graphics and Multimedia lab where sessional classes of different course on computer graphics and multimedia theory can be conducted. This lab has 44 computers where 40 students can work at a time. Moreover, students undertaking different graphics design project also are assisted by all required accessories and components. Regular project showcasing is held in this lab.

Database Lab: The Database lab is consisting of 44 computers as workstations for 40 students at a time providing each one PC and other related equipments. Here, courses associated with database are conducted. Student would be highly benefited through this lab in their database project works.

Digital Logic Design Lab: This lab is enriched with modern electronic equipment and facilities where sessional classes of different courses on digital electronics can be conducted. Oscilloscopes and other associated electronics equipments are available in Digital Logic Design lab that can accommodate 12 groups at a time.

Mobile Game and Apps Testing Lab: CSE department has a Mobile Game and Apps Testing lab with high-tech PCs, modern HP color laser printers, multimedia projector, scanner and cameras with air conditioning environment. Students would be highly benefited through this lab in their mobile and apps development project works.

Sheikh Russel Digital Lab: Our department has a Sheikh Russel Digital lab consisting of 10 computers as workstations. With co-located Mobile Game and Apps Testing lab, classes can be conducted for students providing each one PC and other equipments. This lab is devoloped by the ICT Ministry of Bangladesh.

Other Computing Resources: CSE department has DELL and HP servers connecting all the PCs of BAUET by Intranet, providing internet and other services. It has all the necessary equipment for multimedia lab. We have 24/7 hours Internet facilities including Wi-Fi.

Labs Planned for Future Expansion: This department will establish following labs in future: (1) AI and Robotics Lab (2) IoT Lab.

Note: The laboratories of CSE Department are also being utilized by the students of other departments for sessional classes and research work of relevant subjects/courses.

1.11 Research Activities

The research work undertaken by the teachers and students of this department in the last few years is diversified in nature. The faculty members have a good number of publications in different national and international conferences and journals. BAUET also regularly publishes an annual journal where faculties and students of CSE department put their contributions.

1.12 Co-curricular Activities

Students of this department have achieved remarkable success in co-curricular activities like Programming Contests, Software and Hardware Project Competitions, Idea Contest, Poster Presentation etc. Besides, students take part and show significant performance in Debate, Sports and Cultural Programs. CSE department regularly arranges industrial visit, workshop, seminar, ICT Fest, and study tour for the final year students. There are also different types of club activities which are conducted by different departments. For example:

- BAUET Welfare Club
- BAUET Cultural Club
- BAUET Career Club
- BAUET Debating Society
- Nature and Environment Club
- BAUET Computer Society
- BAUET Automation & Robotic Club
- BAUET ICT Club
- BAUET Business Club
- Language & Literature Club, BAUET
- BAUET Games, Sports & Gymnasium Club
- BAUET Photography & Media Club
- BNCC, BAUET
- প্রথম আলো বন্ধু সভা (BAUET)

Chapter 2

Rules and Regulations for Undergraduate Program

2.1 Overview

The CSE Program of BAUET approved by UGC, introduced the Outcome Based Education (OBE) curriculum for conducting courses from 2019-2020 sessions in all corresponding undergraduate batches. Therefore, the rules and regulations mentioned in this paper will be applicable to students for administering undergraduate curriculum through the course system. This will be introduced with an aim of creating a continuous, even and consistent workload throughout the semester for the students.

2.2 Degree Offered

The department offers a degree in Bachelor of Science in Computer Science and Engineering.

2.3 Admission Eligibility

2.3.1 SSC/Dakhil and HSC/Alim Examinations: HSC/Alim or equivalent examination in Science Group with Mathematics, Physics and Chemistry scoring minimum GPA 3.0 for each. The sum total GPA of SSC/Dakhil and HSC/Alim should be minimum 7.0 (with additional subject).

2.3.2 GCE Applicants

a. O Level: Minimum C Grade in five subjects including, Mathematics, Physics and Chemistry (in the scale of A=5, B=4, C=3, D=2 and E=1)

b. A Level: Minimum C Grade in 2 subjects including Mathematics, Physics/Chemistry.

c. The sum total of GOA in GCE A and O level should be 6.

d. The candidates with E grade in any subject will not be considered.

2.4 Number of Semesters in a Year

There will be two Semesters in an academic year.

a. 1st Semester (Summer)
b. 2nd Semester (Fall)

Calculation:

The minimum total credit hours for earning degree of the program is 161

For, Theory: 770 min = 1 credit hour
Sessional: 1540 min=1 credit hour

In CSE course curriculum,

Total contact hour = 118.00
Total sessional contact hour = 84.00
Total weeks in a semester = 14
One contact hour = 55 minutes

For theory: Total Credit Hour $= \frac{\text{Total contact hour X 55 minutes X 14 weeks}}{\text{1 contact hour X 14 weeks}}$

$= \frac{\text{118 X 55min X 14 Weeks}}{\text{770 minutes}}$

$= 118$ credit hour

For sessional: Total Credit Hour $= \frac{\text{Total contact hour X 55 minutes X 14 weeks}}{\text{1 contact hour X 14 weeks X 2}}$

$= \frac{\text{84 X 55min X 14 Weeks}}{\text{1540 minutes}}$

$= 42$ credit hour

Total calculated Credit Hour= Total Credit Hour for Theory + Total Credit Hour for Sessional

= (118 + 42+1*) Credit Hour

=***161 Credit Hour***

One credit hour extra added for industrial attachment.

Calculated Credit Hour 161 credit hour > 130 credit hour, which satisfied the program compliance criteria.

2.5 Duration of Semesters

2.5.1 Semesters and Duration: There will be two Semesters: 1st Semester and 2nd Semester. 1st Semester will be of 24 weeks and 2nd Semester will be of 28 weeks (Total 52 weeks). An Academic Calendar will be provided to all the enrolled students to make them familiar to all academic events. The holiday will also be included in the calendar.

2.5.2 Annual Semesters Plan: Duration of 1st Semester and 2nd Semester will be as follows:

1st Semester:

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
Total		**24 weeks**

2nd Semester

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
8.	Industrial Training and Survey Practical	4 weeks
Total		**28 weeks**

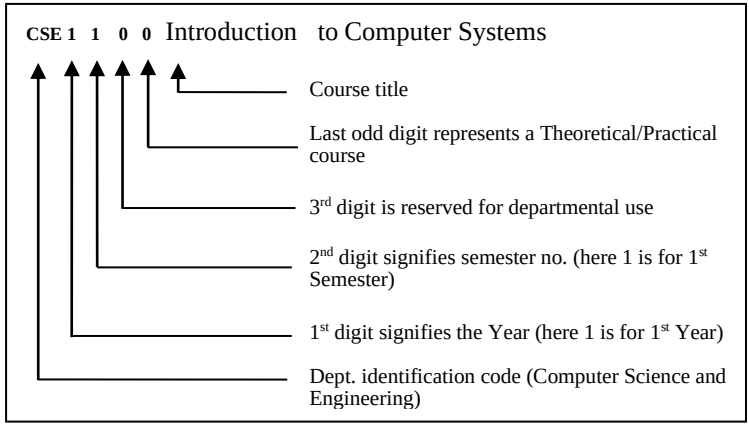
Note: Those who will not be able to clear any of the courses (only theoretical) of any discipline in a particular Semester (1st Semester and 2nd Semester) will be required to appear at the referred examination (Re-examination) for fulfilling the condition as per policy to clear the subject(s).

2.6 Course Pattern and Credit Structure

The undergraduate program is covered by a set of theoretical courses along with a set of laboratories (sessional) courses to support them.

2.7 Course Designation System

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



- The first digit will correspond to the year in which the course is normally taken by the students.
- The second digit will correspond to the semester (1^{st} and 2^{nd}) in which the course is normally taken by the students.
- The third digit will be reserved for departmental use. It usually identifies a specific area/group of study within the department.
- The last digit will be odd number for theoretical courses and even number for sessional courses.

2.8 Assignment of Credits
The course designation system is illustrated as Follows:

The assignment of credits to a theoretical course follows a different rule from that of a sessional course.

a. **Theoretical Courses:** One lecture per week per semester is equivalent to one credit.

b. **Sessional Courses:** Two sessional contact hour per week per semester is equivalent to one credit.

c. Credits are also assigned to project and thesis work taken by the students. The amount of credits assigned to such work varies from one discipline to another.

2.9 Types of Courses

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

a. **Core Courses:** In each discipline, a number of courses are identified as core courses, which form the nucleus of the respective bachelor's degree program. A student has to complete all designated core courses of his/her discipline.

b. **Prerequisite Courses:** A prerequisite course is one of the core courses which should be completed before taking some other course(s).

c. **Optional Courses:** Apart from the core courses, a required number of optional courses from a specified group have to be chosen.

d. **Integrated Design Project (IDP)/Capstone Project and Thesis:** Integrated Design Project/ Capstone Project with two phases has to complete in the combine duration of two semesters in 3^{rd} Year, 2^{nd} Semester, phase-I (credit hour 0.75 and contact hour 1.50) and 4^{th} Year, 1^{st} Semester, phase-II (credit hour 0.75 and contact hour 1.50). The thesis/project will have to be undertaken in 4^{th} Year by students under separate supervisors in partial fulfillment of the requirement of his/her degree. Credits allotted to the thesis will be 6.00 and corresponding 12.00 contact hours where 6.00 contact hours in 4^{th} Year, 1^{st} Semester and another 6.00 contact hours in 4^{th} Year, 2^{nd} Semester.

2.10 Course Appraisal and Lesson Plan: All faculty members must have to prepare their respective Course Appraisal and Lesson plan for the entire course before the

semester begins. They are advised to leave a copy of the Course Appraisal set to the Head of the Department for review by the Course Committee.

2.11 Teacher-Student Interaction

The new course system encourages students to come in close contact with the teachers. For promotion of a high level of teacher-student interaction, each student is assigned to an adviser and the student is free to discuss all academic matters with his/her adviser. Students are also encouraged to meet any time with other teachers for help and guidance in academic matters. However, students are not allowed to interact with teachers after the moderation of questions.

2.11.1 Student Mentoring

Besides the respective faculty of each subject/program, every student will have a designated mentor. Students will interact with his/her mentor to discuss the academic progress, difficulties and all other issues relating to their performances. There is definite guideline issued, which specifies the modalities and frequency of mentoring, advising and interactions.

2.11.2 Student Adviser

One adviser is normally appointed for a batch of students by the concerned department. The adviser advises each student about the courses to be taken in each semester by discussing the academic program of that particular semester with the student. However, it is also the student's responsibility to keep regular contact with his/her adviser who will review and eventually approve the student's specific plan of study and monitor subsequent progress of the student.

2.12 Course Registration

Any student who uses classroom, laboratory facilities or faculty-time is required to register formally. Upon admission to the BAUET, students are assigned to advisers. These advisers guide the students in choosing and registering courses.

2.12.1 Registration Procedure

At the commencement of each semester, each student has to register for courses in consultation with and under the guidance of his/her adviser. The date, time and venue of registration are announced in advance by the Registrar's Office. Counseling and advising are accomplished at this time. It is absolutely essential that all the students be present for registration at the specified time.

2.12.2 Pre-Conditions for Registration

a. For 1st Year students, department-wise enrolment/admission is mandatory prior to registration. At the beginning of the first semester, an orientation program will be conducted for them where they are handed over with the registration package on submission of the enrolment slip.

b. Any student, other than the new batch, with outstanding dues to the BAUET or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.
c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any semester, the concerned department may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

2.12.3 Registration Deadline

Each student must register for the courses to be taken before the commencement of each semester. Late registration is permitted only during the first week of classes. Late registration after this date will not be accepted unless the student submits a written application to the registrar through the concerned Head of the department explaining the reasons for delay. Acceptable reasons may be medical problems with supporting documents or some other academic commitments that prohibit enrolment prior to the last date of registration.

2.12.4. Penalty for Late Registration

Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 400.00 (Four hundred only) for each semester. Penalty for late registration will not be waived.

2.13 Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of six academic years for completion of B.Sc. Engineering degree.

2.14 Attendance, Conduct and Discipline

BAUET has strict rules regarding the issues of attendance in class and discipline.

2.14.1 Attendance: Following guidelines are to be adjusted to:
a. All students are required to attend 80% of the classes for all courses.
b. In case of sickness 70% attendance may be considered by the VC with proper medical documents provided by the student.
c. Students failing to attend 80% classes are liable to pay a fine of Tk. 2000/- per course.
d. Students not eligible to sit for exam of a particular course due to poor attendance, their concerned course will be deleted form the Admit Card.
e. A student will not be entitled to Vice Chancellor or the Dean's list of the Semester, in case he/she has not attended 90% if the classes. S/he will also not be considered for any Scholarship/Waiver provide by the University.

The guidelines for attendance marks are as follows:

Category	Marks
For Theory Course	5
For Sessional Courses	10

The attendance marks distribution for the final assessment is as following:

Attendance (100)	Theory (05) Marks	Sessional (10) Marks
90% and above	05	As per earned percentage (%) of Attendance.
85% to 89%	4.5	
80% to 84%	04	
75% to 79%	3.9	
70% to 74%	03	
Below 70%	00	

2.14.2 Conduct and Discipline: During their stay in BAUET 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 BAUET authority in order to enhance student's physical, intellectual, moral and ethical development. Zero tolerance will be shown in regards of sexual abuse and harassment in any forms and drug abuse and addiction in the campus.

2.15 The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory course this continuous assessment is made through a set of quizzes/class tests, observations/class participation, homework/assignment and a semester final examination. The assessment in laboratory courses is made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. 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. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be awarded in accordance with the provisions (as per University Grant Commission-UGC grading system) shown below:

Numerical Score	Letter Grade		Grade points
80% and above	A+	A (Plus)	4.00
75% to below 80%	A	A (Regular)	3.75
70% to below 75%	A-	A (Minus)	3.50
65% to below 70%	B+	B (Plus)	3.25
60% to below 65%	B	B (Regular)	3.00
55% to below 60%	B-	B (Minus)	2.75
50% to below 55%	C+	C (Plus)	2.50
45% to below 50%	C	C (Regular)	2.25
40% to below 45%	D	D (Pass)	2.00

Below 40%	F	Fail	0.00
Incomplete	I	-	-
Withdrawal	W	-	-
Project/Thesis Continuation	X	-	-

* Subject in which the student gets F grade shall not be regarded as earned credit hours for the calculation of Grade Point Average. (GPA)

2.16 Distribution of Marks

Theory

Thirty percent (30%) marks of theoretical course shall be allotted for continuous assessment, i.e., quiz, class tests, home assignments, class evaluation and class participation and 70% shall be allotted to the Semester Final Examination. The Final examination is conducted centrally by the University. Distribution of marks for a given course if as follows.

Category	**Marks %**
Class participation/Presentation skill	5
Class performance	5
Homework/Assignment	5
Class tests	15
Final Examination (Maximum 3 Hours)	70
Total	**100**

Sessional/Practical Examinations

The marks for the Sessional Courses will be distributed according to the type of the sessional course. The distribution of marks for three types of sessional is given below:

Students failing in sessional/practical course will have to register that course at his/her next upcoming convenient semester with a course registration fee fixed by the BAUET authority but within maximum period of six academic years.

For B.Sc. in CSE program, the marks distribution of sessional courses will be distributed according to the type of the sessional course. The distributions of marks for three types of sessional are given below:

Marks Distribution of Lab/Project Based Sessional

Category	**Marks %**
Lab test/Project	30

Written test/Quiz	20
Viva voce	10
Attendance	10
Data Sheet/Home Assignments/Report	10
Class Performance /Continuous Evaluation	20
Total	**100**

Marks Distribution of Programming Based Sessional

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva voce	10
Attendance	10
Continuous Evaluation	10
Class Performance	20
Total	**100**

Sessional Course of Communicative English

The distribution will be as under:

Class Participation	5
Class Assessment	5
Written Assignment	15
Oral Performance	25
Listening Skill	10
Group Presentation	30
Viva Voce	10
Total	**100**

2.17 Calculation of GPA (Grade Point Average)

Grade Point Average (GPA) is the weighted average of the grade points obtained from all the courses passed/completed by a student. For Example, if a student passes/completes 'n' courses in a semester having credits of C_1, C_2.....,C_n and his/her grade points in these courses are G_1, G_2,....., G_n respectively,

$$GPA = \frac{\sum_{i=1}^{n} Ci \times Gi}{\sum_{i=1}^{n} Ci}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the semesters passed/completed by a student. For example, if a student passes/completes 'n' semester having total credits of TC_1,TC_2....., TC_n and his/her GPA in these semesters are GPA_1, GPA_2 .....GPA_n respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TCi \times GPAi}{\sum_{i=1}^{n} TCi}$$

A Numerical Example

Suppose a student has completed 09 (nine) courses in a semester and obtained the following grades:

Course	Credits, C_i	Grade	Grade Points, G_i	C_i*G_i
CSE-1100	1.50	A-	3.50	5.2500
EEE-1163	3.00	A+	4.00	12.0000
EEE-1164	1.50	A	3.75	5.6250
MATH-1141	3.00	B+	3.25	9.7500
PHY-1101	3.00	B-	2.75	8.2500
PHY-1102	0.75	C+	2.50	1.8750
GED-1151	3.00	D	2.00	6.0000
GED-1152	0.75	C	2.25	1.6875
GED-1153	2.00	B	3.00	6.0000
Total	**18.50**			**56.4375**

GPA= 56.4375/18.50=3.05

Suppose a student has completed 04 (four) semesters and obtained the following GPA:

Year	Semester	Credit Hours Earned, TC_i	GPA Earned, GPA_i	TC_i*GPA_i
1st	1st	21.00	3.73	78.330
1st	2nd	20.50	3.93	80.565
2nd	1st	19.75	3.96	78.210
2nd	2nd	20.25	4.00	81.000
Total		**81.50**		**318.105**

CGPA = 318.105/81.50 =3.90

2.18 Promotion to the Next Semester

[As per BAUET Exam policy]

2.19 Minimum Earned Credit and CGPA (Cumulative Grade Point Average) Required for Obtaining a Degree

[As per BAUET Exam policy]

2.20 Consequences of Poor Performance (Re-examination/Referred/Improvement/ Backlog/Semester Repeat)

[As per BAUET Exam policy]

2.21 Withdrawal policy
[As per BAUET Exam policy]

2.22 Class Tests

The number of class test of a course shall be n+1 where n is the number of credits of the course. Evaluation of performance in class tests will be on the basis of the best n class tests. The theme of the continuous assessment that a particular teacher wishes to follow a course will be explained the course outline on the first day of the semester.

2.23 Earned Credits

The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by her/him. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credits. A student who obtains F grade in a Core Course in any semester, he/she will have to appear at referred exam.

If a student obtains F grade in an optional course, he/she may choose to appear the referred examination or to take a substitute course if available, F grades will not be counted for GPA calculation but will stay permanently on the Grade Sheet and Transcript.

2.24 Rounding off the Decimal Marks

If there are any decimal marks in any of the examinations like class test, tutorial, semester paper, viva voce, course final examination, 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 summation of all the subject/sessional marks. To round off, 0.5 and above is to be converted to next higher whole number (Integer) and less than 0.5 is to be converted to previous whole number (For example 58.5% would be 59% and 58.49% would 58%).

2.25 Rounding off the GPA/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 figures of decimal. To round of 3.555 and above after two figures of decimal, it is to be rounded off as 3.56 and 3.554 and below after two figures of decimal, it is to be rounded off as 3.55.

2.26 Number of Grade Sheets

The number of Grade sheets to be issued is 08 (eight) for a regular student. Backlog, re-registered courses, sessional courses result will be included in that particular semester result in which the student appeared.

2.27 Transcript

Transcripts will be given after approval of the authority of BAUET, academic council and syndicate. Partial transcripts may be given to students with the assigned payment and verification fixed by the authority.

2.28 Certificate

A copy of provisional before original certificate may be given after approval of the authority of BAUET, academic council and syndicate. Provisional certificates, however, should be surrendered during receiving the original certificate.

2.29 Recognition of Performance

a. Degree with Honors: Candidates for Bachelor's Degree will be awarded the degree with honors if their CGPA is 3.75 and better.

b. Gold Medal: Gold medal will be awarded to all the students earning CGPA 4.00 at the end of the entire program and the first position holder in his department earning a minimum CGPA of 3.80.

c. VC's List and Dean's List: VC's List Certificate will be awarded to the graduating students based on their earned CGPA considering results of the entire program (1st Year to 4th Year). Dean's List of honor will be awarded each academic year. The required GPA or CGPA to be considered in the Dean's and VC's list award is as under:

Certificate	
VC's List	**Dean's List**
3.90 & above	3.75 & below 3.90

d. Other Scholarships and Stipends: This will be considered by the university authority in due course of time.

****Students must have above 90% attendance to be considered in the Dean's list and VC's list of recognition.**

[N.B. Contradiction among the existing Examination Policy, Syllabus and Standing Instruction (SI) will be solved by a team headed by the honorable VC]

Chapter 3

Course Requirements for the Students of Undergraduate Program (B. Sc in CSE)

3.1 Semester wise courses for CSE Undergraduate Program

1st Year 1st Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-1101	Introduction to Computer Systems	2.00	-	2.00	
2.	CSE-1102	Introduction to Computer Systems Sessional	-	3.00	1.50	
3.	PHY-1105	Physics	3.00	-	3.00	
4.	PHY-1106	Physics Sessional	-	1.50	0.75	
5.	MATH-1141	Differential Calculus and Integral Calculus	3.00	-	3.00	
6.	HUM-1151	Technical and Communicative English	2.00	-	2.00	
7.	HUM-1152	Technical and Communicative English Sessional	-	3.00	1.50	
8.	HUM-1153	Bengali Language and Literature	2.00	-	2.00	
		Total	**12.00**	**7.50**	**15.75**	

1st Year 2nd Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-1211	Discrete Mathematics	3.00	-	3.00	
2.	CSE-1213	Structured Programming	3.00	-	3.00	
3.	CSE-1214	Structured Programming Sessional	-	3.00	1.50	
4.	EEE-1261	Electrical Circuit Analysis	3.00	-	3.00	
5.	EEE-1262	Electrical Circuit Analysis Sessional	-	3.00	1.50	

6.	CE-1270	Engineering Drawing and CAD Sessional	-	1.50	0.75	
7.	CHEM-1203	Inorganic and Physical Chemistry	3.00	-	3.00	
8.	CHEM-1204	Inorganic and Physical Chemistry Sessional	-	1.50	0.75	
9.	MATH-1243	Ordinary, Partial Differential Equations and Coordinate Geometry	3.00	-	3.00	
10.	HUM-1255	Bangladesh Studies (History of Independence)	2.00	-	2.00	
		Total	**17.00**	**9.00**	**21.50**	

2nd Year 1st Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-2101	Digital Logic Design	3.00	-	3.00	
2.	CSE-2102	Digital Logic Design Sessional	-	1.50	0.75	
3.	CSE-2103	Data Structures and Algorithms-I	3.00	-	3.00	CSE-1213
4.	CSE-2104	Data Structures and Algorithms-I Sessional	-	3.00	1.50	
5.	CSE-2105	Object Oriented Programming	3.00	-	3.00	CSE-1213
6.	CSE-2106	Object Oriented Programming Sessional	-	3.00	1.50	
7.	EEE-2163	Electronic Devices and Circuits	3.00	-	3.00	EEE-1261
8.	EEE-2164	Electronic Devices and Circuits Sessional	-	1.50	0.75	
9.	MATH- 2145	Vector Analysis, Matrices and Fourier Analysis	3.00	-	3.00	
		Total	**15.00**	**9.00**	**19.50**	

2nd Year 2nd Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-2211	Database Management Systems	3.00	-	3.00	
2.	CSE-2212	Database Management Systems Sessional	-	3.00	1.50	
3.	CSE-2213	Data Structures and Algorithms-II	3.00	-	3.00	CSE-2103
4.	CSE-2214	Data Structures and Algorithms-II Sessional	-	3.00	1.50	
5.	CSE-2215	Digital Electronics and Pulse Technique	3.00	-	3.00	EEE-2163 CSE-2101
6.	CSE-2216	Digital Electronics and Pulse Technique Sessional	-	1.50	0.75	
7.	CSE-2218	Advanced Programming Sessional	-	3.00	1.50	CSE-2105
8.	EEE-2265	Electrical Drives and Instrumentation	3.00	-	3.00	EEE-2163
9.	EEE-2266	Electrical Drives and Instrumentation Sessional	-	1.50	0.75	
10.	MATH- 2247	Complex Variable and Laplace Transformation	3.00	-	3.00	
		Total	**15.00**	**12.00**	**21.00**	

3rd Year 1st Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-3101	Numerical Analysis	3.00	-	3.00	
2.	CSE-3102	Numerical Analysis Sessional	-	1.50	0.75	
3.	CSE-3103	Software Engineering and Information System Design	3.00	-	3.00	

4.	CSE-3104	Software Engineering and Information System Design Sessional	-	1.50	0.75	
5.	CSE-3105	Data and Telecommunication	3.00	-	3.00	
6.	CSE-3106	Data and Telecommunication Sessional	-	1.50	0.75	
7.	CSE-3107	Operating System	3.00	-	3.00	
8.	CSE-3108	Operating System Sessional	-	3.00	1.50	
9.	CSE-3110	Web Programming Sessional	-	3.00	1.50	
10.	HUM-3157	Professional Ethics and Environmental Protection	3.00	-	3.00	
		Total	**15.00**	**10.50**	**20.25**	

3rd Year 2nd Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
	CSE-3200	Integrated Design Project / Capstone Project (Phase I)**	-	1.50	0.75	CSE-1213, CSE- 2103, CSE-2105, CSE-2213, and their corresponding sessional, CSE-2218*
1.	CSE-3211	Computer Network	3.00	-	3.00	
2.	CSE-3212	Computer Network Sessional	-	3.00	1.50	
3.	CSE-3213	Computer Architecture	3.00	-	3.00	CSE-2101
4.	CSE-3215	Digital Image Processing	3.00	-	3.00	
5.	CSE-3216	Digital Image Processing Sessional	-	3.00	1.50	

6.	CSE-3222	Programming with Assembly Language Sessional	-	1.50	0.75	
7.	HUM-3259	Engineering Economics and Sociology	3.00	-	3.00	
8.	HUM-3261	Financial and Managerial Accounting	2.00	-	2.00	
		Total	**14.00**	**9.00**	**18.50**	

***3rd Year Industrial Training**

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-3224	Industrial Training*	-	4 Weeks	1.00	

***Note:** CSE-3224 (Industrial Training) will be conducted at any convenient time after the 3rd Year, 2nd Semester for duration of 04 weeks as applicable or decided by the department. Evaluation report from industry is to be submitted at the end of the training and accordingly to be incorporated in the tabulation sheet.

****Note:** Each student has to complete one Integrated Design Project / Capstone Project in the combined duration of two consecutive semesters of 3rd Year 2nd Semester and 4th Year 1st Semester.

4th Year 1st Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-4000	Project / Thesis***	-	6.00	3.00	
	CSE-4100	Integrated Design Project / Capstone Project(Phase II)**	-	1.50	0.75	CSE-3200
2.	CSE-4101	Microprocessors, Micro-controllers and Embedded System	3.00	-	3.00	CSE-2101
3.	CSE-4102	Microprocessors, Micro-controllers and Embedded System Sessional	-	1.50	0.75	
4.	CSE-4103	Compiler Design	3.00	-	3.00	CSE 2103 CSE 2213
5.	CSE-4104	Compiler Design Sessional	-	1.50	0.75	

6.	CSE-4106	Technical Writing and Presentation Sessional	-	1.50	0.75	
7.	MATH-4107	Applied Statistics and Queuing Theory	3.00	-	3.00	
8.	HUM-4163	Technology Enterprenurship and Leadership	3.00	-	3.00	
9.	CSE-41XO	Option-I	3.00	-	3.00	
		Total	**15.00**	**12.00**	**21.00**	

*****Note:** Each student has to complete one Project or Thesis in the combined duration of two semesters of 4th Year. In course CSE-4000 (Project / Thesis), a student has to make a proposal defence at the end of the semester. The defenced project/thesis has to be completed in the continuation course CSE-4000 (Project / Thesis) in next semester.

Option-I

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-4121	Advanced Algorithms	3.00	-	3.00	
2.	CSE-4123	Basic Graph Theory	3.00	-	3.00	
3.	CSE-4125	Fault Tolerant System	3.00	-	3.00	
4.	CSE-4127	Object Oriented Software Engineering	3.00	-	3.00	
5.	CSE-4129	Artificial Neural Networks and Fuzzy Systems	3.00	-	3.00	
6.	CSE-4131	Computer Vision	3.00	-	3.00	
7.	CSE-4133	Bioinformatics	3.00	-	3.00	
8.	CSE-4135	Robotics	3.00	-	3.00	
9.	CSE-4137	Machine Learning	3.00	-	3.00	
10.	CSE-4139	VLSI Design	3.00	-	3.00	

4th Year 2nd Semester

Sl.	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-4000	Project / Thesis***	-	6.00	3.00	

2.	CSE-4201	Artificial Intelligence	3.00	-	3.00	
3.	CSE-4202	Artificial Intelligence Sessional	-	1.50	0.75	
4.	CSE-4203	Data and Network Security	3.00	-	3.00	
5.	CSE-4205	Computer Graphics	3.00	-	3.00	
6.	CSE-4206	Computer Graphics Sessional	-	3.00	1.50	
7.	CSE-4207	Digital Signal Processing	3.00	-	3.00	
8.	CSE-4208	Digital Signal Processing Sessional	-	1.50	0.75	
9.	CSE-42XO	Option-II	3.00	-	3.00	
10.	CSE-42XE	Option-II Sessional	-	3.00	1.50	
		Total	**15.00**	**15.00**	**22.50**	

Option-II

Sl.	**Course No**	**Course Title**	**Hours/Week**		**Credits**	**Pre-requisite**
			Theory	**Sessional**		
1.	CSE-4241	Human Computer Interaction	3.00	-	3.00	
2.	CSE-4242	Human Computer Interaction Sessional	-	1.50	0.75	
3.	CSE-4243	Pattern Recognition	3.00	-	3.00	
4.	CSE-4244	Pattern Recognition Sessional	-	1.50	0.75	
5.	CSE-4245	Mobile and Ubiquitous Computing	3.00	-	3.00	
6.	CSE-4246	Mobile and Ubiquitous Computing Sessional	-	1.50	0.75	
7.	CSE-4247	Simulation and Modeling	3.00	-	3.00	
8.	CSE-4248	Simulation and Modeling Sessional	-	1.50	0.75	
9.	CSE-4249	Data Mining and Data Ware-housing	3.00	-	3.00	
10.	CSE-4250	Data Mining and Data Ware-housing Sessional	-	1.50	0.75	
11.	CSE-4251	Advanced Database Management Systems	3.00	-	3.00	

12.	CSE-4252	Advanced Database Management Systems Sessional	-	1.50	0.75	
13.	CSE-4253	Internet of Things (IoT)	3.00	-	3.00	
14.	CSE-4254	Internet of Things (IoT) Sessional	-	1.50	0.75	

3.2 Courses for CSE Undergraduate Program

3.2.1 Core Courses (CSE)

Sl.	Course No	Course Title	Credits Hours
1.	CSE-1101	Introduction to Computer Systems	2.00
2.	CSE-1102	Introduction to Computer Systems Sessional	1.50
3.	CSE-1211	Discrete Mathematics	3.00
4.	CSE-1213	Structured Programming	3.00
5.	CSE-1214	Structured Programming Sessional	1.50
6.	CSE-2101	Digital Logic Design	3.00
7.	CSE-2102	Digital Logic Design Sessional	0.75
8.	CSE-2103	Data Structures and Algorithms-I	3.00
9.	CSE-2104	Data Structures and Algorithms-I Sessional	1.50
10.	CSE-2105	Object Oriented Programming	3.00
11.	CSE-2106	Object Oriented Programming Sessional	1.50
12.	CSE-2211	Database Management Systems	3.00
13.	CSE-2212	Database Management Systems Sessional	1.50
14.	CSE-2213	Data Structures and Algorithms-II	3.00
15.	CSE-2214	Data Structures and Algorithms-II Sessional	1.50
16.	CSE-2215	Digital Electronics and Pulse Technique	3.00
17.	CSE-2216	Digital Electronics and Pulse Technique Sessional	0.75
18.	CSE-2218	Advanced Programming Sessional	1.50
19.	CSE-3101	Numerical Analysis	3.00
20.	CSE-3102	Numerical Analysis Sessional	0.75
21.	CSE-3103	Software Engineering and Information System Design	3.00
22.	CSE-3104	Software Engineering and Information System Design Sessional	0.75
23.	CSE-3105	Data and Telecommunication	3.00
24.	CSE-3106	Data and Telecommunication Sessional	0.75
25.	CSE-3107	Operating System	3.00
26.	CSE-3108	Operating System Sessional	1.50
27.	CSE-3110	Web Programming Sessional	1.50
28.	CSE-3200	Integrated Design Project / Capstone Project (Phase I)**	0.75
29.	CSE-3211	Computer Network	3.00
30.	CSE-3212	Computer Network Sessional	1.50
31.	CSE-3213	Computer Architecture	3.00

32.	CSE-3215	Digital Image Processing	3.00
35.	CSE-3216	Digital Image Processing Sessional	1.50
36.	CSE-3222	Programming with Assembly Language Sessional	0.75
37.	CSE-3224	Industrial Training	1.00
38.	CSE-4000	Project / Thesis	6.00
39.	CSE-4100	Integrated Design Project / Capstone Project (Phase II)**	1.50
40.	CSE-4101	Microprocessors, Micro-controllers and Embedded System	3.00
41.	CSE-4102	Microprocessors, Micro-controllers and Embedded System Sessional	0.75
42.	CSE-4103	Compiler Design	3.00
43.	CSE-4104	Compiler Design Sessional	0.75
44.	CSE-4106	Technical Writing and Presentation Sessional	0.75
45.	CSE-4107	Applied Statistics and Queuing Theory	3.00
	CSE-41XO	**Option-I**	**3.00**
46.	CSE-4121	Advanced Algorithms	3.00
47.	CSE-4123	Basic Graph Theory	3.00
48.	CSE-4125	Fault Tolerant System	3.00
49.	CSE-4127	Object Oriented Software Engineering	3.00
50.	CSE-4129	Artificial Neural Networks and Fuzzy Systems	3.00
51.	CSE-4131	Computer Vision	3.00
52.	CSE-4133	Bioinformatics	3.00
53.	CSE-4135	Robotics	3.00
54.	CSE-4137	Machine Learning	3.00
55.	CSE-4139	VLSI Design	3.00
56.	CSE-4201	Artificial Intelligence	3.00
57.	CSE-4202	Artificial Intelligence Sessional	0.75
58.	CSE-4203	Data and Network Security	3.00
59.	CSE-4205	Computer Graphics	3.00
60.	CSE-4206	Computer Graphics Sessional	1.50
61.	CSE-4207	Digital Signal Processing	3.00
62.	CSE-4208	Digital Signal Processing Sessional	0.75
	CSE-42XO	**Option-II**	**3.00**
	CSE-42XE	**Option-II Sessional**	**1.50**
63.	CSE-4241	Human Computer Interaction	3.00
64.	CSE-4242	Human Computer Interaction Sessional	1.50
65.	CSE-4243	Pattern Recognition	3.00
66.	CSE-4244	Pattern Recognition Sessional	1.50
67.	CSE-4245	Mobile and Ubiquitous Computing	3.00
68.	CSE-4246	Mobile and Ubiquitous Computing Sessional	1.50
69.	CSE-4247	Simulation and Modeling	3.00
70.	CSE-4248	Simulation and Modeling Sessional	1.50
71.	CSE-4249	Data Mining and Data Ware-housing	3.00
72.	CSE-4250	Data Mining and Data Ware-housing Sessional	1.50
73.	CSE-4251	Advanced Database Management Systems	3.00
74.	CSE-4252	Advanced Database Management Systems Sessional	1.50

75.	CSE-4253	Internet of Things (IoT)	3.00
76.	CSE-4254	Internet of Things (IoT) Sessional	1.50

3.2.2 Core Courses (EEE)

Sl.	Course No	Course Title	Credits Hours
1.	EEE-1261	Electrical Circuit Analysis	3.00
2.	EEE-1262	Electrical Circuit Analysis Sessional	1.50
3.	EEE-2163	Electronic Devices and Circuits	3.00
4.	EEE-2164	Electronic Devices and Circuits Sessional	0.75
5.	EEE-2265	Electrical Drives and Instrumentation	3.00
6.	EEE-2266	Electrical Drives and Instrumentation Sessional	0.75

3.2.3 Core Courses (CE)

Sl.	Course No	Course Title	Credits Hours
1.	CE-1270	Engineering Drawing and CAD Sessional	0.75

3.2.4 Core Courses (MATH)

Sl.	Course No	Course Title	Credits Hours
1.	MATH-1141	Differential Calculus and Integral Calculus	3.00
2.	MATH-1243	Ordinary, Partial Differential Equations and Coordinate Geometry	3.00
3.	MATH- 2145	Vector Analysis, Matrices and Fourier Analysis	3.00
4.	MATH- 2247	Complex Variable and Laplace Transformation	3.00

3.2.5 Core Courses (Physics)

Sl.	Course No	Course Title	Credits Hours
1.	PHY-1105	Physics	3.00
2.	PHY-1106	Physics Sessional	0.75

3.2.6 Core Courses (Chemistry)

Sl.	Course No	Course Title	Credits Hours
1.	CHEM-1203	Inorganic and Physical Chemistry	3.00
2.	CHEM-1204	Inorganic and Physical Chemistry Sessional	0.75

3.2.7 Core Courses (Humanities)

Sl.	Course No	Course Title	Credits Hours
1.	HUM-1151	Technical and Communicative English	2.00
2.	HUM-1152	Technical and Communicative English	1.00

		Sessional	
3.	HUM-1153	Bengali Language and Literature	2.00
4.	HUM-1255	Bangladesh Studies (History of Independence)	2.00
5.	HUM-3157	Professional Ethics and Environmental Protection	3.00
6.	HUM-3259	Engineering Economics and Sociology	3.00
7.	HUM-3261	Financial and Managerial Accounting	2.00
8.	HUM-4163	Technology Entrepreneurship and Leadership	3.00

3.3 Course Summary for CSE Undergraduate Program Summary

Summary of Departmental, Other Engineering, Basic Science and Humanities Theory and Sessional Courses								
Year/Semester	**Hours/Week**		**Total Cont. Hours**	**Credits**		**Total Credits**	**No of Courses**	
	Theory	**Sessional**		**Theory**	**Sessional**		**Theory**	**Sessional**
1st Year 1st Semester	12.00	7.50	19.50	12.00	3.75	15.75	5	3
1st Year 2nd Semester	17.00	9.00	26.00	17.00	4.50	21.50	6	4
2nd Year 1st Semester	15.00	9.00	24.00	15.00	4.50	19.50	5	4
2nd Year 2nd Semester	15.00	12.00	27.00	15.00	6.00	21.00	5	5
3rd Year 1st Semester	15.00	10.50	25.50	15.00	5.25	20.25	5	5
3rd Year 2nd Semester	14.00	9.00	23.00	14.00	4.50+1	19.50	5	4
4th Year 1st Semester	15.00	12.00	27.00	15.00	6.00	21.00	5	5
4th Year 2nd Semester	15.00	15.00	30.00	15.00	7.50	22.50	5	5
Grand Total	**118.00**	**84.00**	**202.0**	**118.00**	**43.00**	**161.00**	**41**	**35**

Summary of Departmental Theory and Sessional Courses (Credits)			
Year/Semester	**Theory**	**Sessional**	**Total**
1st Year 1st Semester	2.00	1.50	3.50
1st Year 2nd Semester	6.00	1.50	7.50
2nd Year 1st Semester	9.00	3.75	12.75
2nd Year 2nd Semester	9.00	5.25	14.25
3rd Year	12.00	5.25	17.25

1st Semester			
3rd Year 2nd Semester	9.00	4.50+1	14.50
4th Year 1st Semester	9.00	6.00	15.00
4th Year 2nd Semester	15.00	7.50	22.50
Total	**74.00**	**36.25**	**107.25**

Summary of Departmental, Other Engineering, Basic Science and Humanities Courses (Credits)					
Year/Semester	**Departmental**	**Other Engineering**	**Basic Science**	**Humanities**	**Total**
1st Year 1st Semester	3.50	0.00	6.75	5.50	15.75
1st Year 2nd Semester	7.50	5.25	6.75	2.00	21.50
2nd Year 1st Semester	12.75	3.75	3.00	0.00	19.50
2nd Year 2nd Semester	14.25	3.75	3.00	0.00	21.00
3rd Year 1st Semester	17.25	0.00	0.00	3.00	20.25
3rd Year 2nd Semester	14.50	0.00	0.00	5.00	19.50
4th Year 1st Semester	15.00	0.00	3.00	3.00	21.00
4th Year 2nd Semester	22.50	0.00	0.00	0.00	22.50
Total	**107.25**	**12.75**	**22.50**	**18.50**	**161.00**
Percentage (%)	**66.61**	**7.92**	**13.97**	**11.50**	**100.00**

Chapter 4

Detailed Outline of Undergraduate Courses Offered by the Department of Computer Science and Engineering

1st Year 1st Semester
CSE-1101: Introduction to Computer Systems
2 hours/week, 2.00 Cr.

Pre-requisite: None
Course Content:
Computer Basics: Introduction to studying Computers, History and development of Computers, Types of Computers, Major components of a computer.
Computer Hardware and Peripherals: Basic units of Computer Hardware, Keyboard, Mouse, Internal structure of CPU, Functions of RAM, ROM and Cache memory, Basic functional mechanism of HDD and CD-ROM, Different types of Monitors, Impact and non-impact Printers, Scanner, Plotter, Typical Computer specifications.
Software: Classifications, System software, Operating system concepts and importance, components and basic functions of DOS, Windows operating system, Application software's and Utility programs, Computer virus.
Number system: binary, octal, hexadecimal, binary arithmetic.
Data Processing: Concepts of Data, Information, and Database, Traditional File Processing, and DBMS.
Computer Networks: Computer networks and its goals, Basic concepts on LAN, MAN, WAN and Internet systems, Internet services, Functions of Modem in internet.
Programming Language Basic: Basic programming concepts, Programming languages, basic concepts of compiler, interpreter, algorithm and flowchart, Introduction to Object Oriented Programming;

Reference Book (s):

1. Computer Fundamentals (7th Edition) – Peter Norton, McGraw Hill Education (2017).
2. Introduction to Computers, McGraw-Hill Inc- Subramanian
3. The Complete PC Upgrade and Maintenance Guide (16th Edition) – Mark Minasi, Sybex (2005).
4. How to Think Like a Computer Scientist: Learning with Python (2nd Edition) -Allen
5. B. Downey, Samurai Media Limited (2016).
6. Core Python Programming (2nd Edition) - Wesley J Chun, Prentice Hall (2006).

CSE-1102: Introduction to Computer Systems Sessional
3 hours/week, 1.50 Cr.

Pre-requisite: None

Course Content:

Introduction: major components of a computer.
Hardware: processor, memory, I/O devices.
Software: Operating system, application software; Report writing and Presentation; Basic architecture of a computer; Basic Information Technology; Number system: binary, octal, hexadecimal, binary arithmetic; Basic programming concepts.
Program development stages: flow charts; Programming constructs: data types, operators, expressions, statements; Introduction to Object Oriented Programming; An Introduction to Python, Reserved Words, Naming Conventions, Basic Python Syntax, Language Components, Indenting Requirements, Control Statements, Bit Manipulation, Python Collections, Functions, Keyword and Optional Parameters, Lambda, Inner Functions, Modules, Exceptions, Input and Output, Classes in Python, Regular Expressions, Writing GUIs in Python, Python and CGI Scripts, The OS Module, Network Programming, Synchronization, Data Compression, Python and Databases.

Reference Book (s):

1. Computer Fundamentals (7th Edition) – Peter Norton, McGraw Hill Education (2017).
2. Introduction to Computers, Mcgraw-hill Inc- Subramanian
3. The Complete PC Upgrade and Maintenance Guide (16th Edition) – Mark Minasi, Sybex (2005).
4. How to Think Like a Computer Scientist: Learning with Python (2nd Edition) -Allen
5. B. Downey, Samurai Media Limited (2016).
6. Core Python Programming (2nd Edition) - Wesley J Chun, Prentice Hall (2006).

PHY-1105: Physics
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Waves & 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 motion, wave energy.

Optics and Laser: Theories of light: Interference of light, Young's double slit experiment, Fresnel's biprism. 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, Fiberoptics.
Heat and thermodynamics: Principal of temperature measurements, resistance thermometer, thermos-electric thermometer, pyrometer.
Kinetic theory of gases: Maxwell's distribution of molecular speeds, mean free path, equipartition of energy, Brownian motion, Vander Weal's equation of state, review of the first law of the thermodynamics and it's application, reversible and irreversible process, second law of thermodynamics, Carnot cycle, efficiency of heat engines, Carnot's Theorem, entropy and disorder, thermodynamic functions, Maxwell relations, Clavsivs-Clapeyron equation, Gibbs phase rule, third law of thermodynamics.
Structure of Matter: Crystalline and non-crystalline solids, single crystal and polycrystal solids, unit cell, crystal systems, co-ordinations number, crystal planes and directions, sodium chloride and $C_s$cl structure, packing factor, Miller indices, relation between interplanar spacing and Miller indices, Bragg's law, methods of determination of interplanar spacing from diffraction patterns.
Defects in Solids: Point defect, line defects, Bonds in solids, interatomic distances, and calculation of cohesive and bonding energy.
Introduction to Band Theory: Distinction between metal, semiconductor and insulator.

Reference Book (s):

1. Physics for Engineers, Part-1 & Part-2 (4th ed)- Dr. Giasuddin Ahmad, Hafiz Book Centre (2000).
2. Wave sand oscillations (2nded)-Brijlal and Subramannyam, Vikas Publishing House Pvt Ltd(1994).
3. A Text Book of Optics - Brijlal and N. Subrahmanyam, S. Chand (2006).
4. Fundamental of Optics (3rd ed)-Jenkine and White, McGraw Hill(1957).
5. Fundamentals of Physics (10th ed)-Halliday, Resnick and Walker, Wiley(2013).
6. Physics part-I & II (2nd ed) - Resnick and Halliday, John Wiley & Sons, Inc.(1968).

PHY-1106: Physics Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Determination of specific resistance of a wire using a meter bridge, determination of the resistance per unit length of meter bridge wire, determination of mechanical equivalent (J) of heat by the electrical method, determination of electrochemical equivalent (ECE) of

copper by the cooper Voltammeter, determination of resistance of a galvanometer by half deflection method, determination of high resistance by the method of deflection, determination of focal length of a concave lens by auxiliary lens method, determination of radius of a curvature of a Plano convex lens by Newton's ring method, determination of the refractive index of the material of a prism by spectrometer, determination of the specific rotation of sugar solution by Polarimeter, determination of frequency of at running fork by the Melde's experiment, determination of the spring constant and the effective mass of a loaded spring and hence to calculate the rigidity modulus of the spring, determination of the value of g acceleration due to gravity by means of a compound pendulum, determination of Young's modulus of a bar by bending method, determination of the modulus of rigidity of a wire by statistical method.

Reference Book(s):

1. Physics for Engineers, Part-1 & Part-2 (4th Ed) - Dr. Giasuddin Ahmad, Hafiz Book Centre(2000).
2. Waves and oscillations (2nded)-Brijlal and Subramannyam, Vikas Publishing House Pvt Ltd(1994).
3. A Text Book of Optics - Brijlal and N. Subrahmanyam, S. Chand (2006).
4. Fundamental of Optics (3rd Ed)-Jenkine and White, McGraw Hill(1957).
5. Fundamentals of Physics (10th Ed)-Halliday, Resnick and Walker, Wiley(2013).
6. Physics part-I & II (2nd ed.) - Resnick and Halliday, John Wiley & Sons, Inc.(1968)

MATH-1141: Differential Calculus and Integral Calculus
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Differential Calculus: Function, limit, continuity, introduction to differential calculus, differentiability, differentiation, 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, indeterminate form, maxima and minima of functions of single variables, partial differentiation, Euler's theorem, tangent and normal, sub tangent and subnormal in cartesian and polar coordinates, curvature, asymptotes.

Integral Calculus: Introduction to integral calculus, integration by the method of substitution, integration by parts, standard integrals, integration by the method of successive reduction, evaluation of definite integrals, properties of definite integral and its use, summing series, Walli's formula, improper integrals, beta function and gamma function, double integral and multiple integral with its applications, length of curves, area under a plane curve, area of the region enclosed by two curves, volume of solid of revolution.

Reference Book (s):

1. Calculus - Haward Anton (9th Ed) - Stephen Davis, Wiley (2012).
2. Differential Calculus- B. C. Das and B.N. Mukherjee
3. Integral Calculus- B. C. Das and B.N. Mukherjee
4. Differential and Integral Calculus (5th Ed)-Matin Chakraborty, Dhaka Standard Publication (2015).
5. A Text Book on Integral Calculus (4th Ed) - Mohammad, Bhattacharjee & Latif, Dhaka (2010).

HUM-1151: Technical and Communicative English
2 hours in a week, 2.00 Cr.

Pre-requisite: None
Course Content:

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures, why & yes/ no questions, conditional sentences.
Vocabulary: Technical & scientific vocabulary, defining terms.
Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.
Reading: Comprehension of technical & non-technical materials-skimming, scanning, inferring & responding to context.
Technical Writing: Paragraph & composition writing on scientific & other themes, report writing, research paper writing, library references.
Professional communication: Business letter, job application, memos, quotations, tender notice.

Reference Book(s):

1. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication.
2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication.
3. Hand-out will be provided by the instructors.

HUM-1152: Technical and Communicative English Sessional
3.00 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:

Speaking Skills: using greetings, describing people/place/things, Asking and answering questions, expressing likings and disliking; (food, fashion etc.), Asking and giving directions; Practicing storytelling, Introducing presentation skills, Extempore talk.
Listening Skills: Telephone conversations (role play in group or pair), Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation), peer interviews/job interviews.
Writing Skills: Introducing yourself and others; describing personality, discussing and making plans (for a holiday or an outing to the cinema), Discussing everyday routines and habits, making requests/offers/invitations/excuses/ apologies/ complaints, Narrating personal experiences.
Reading Skills: Reading Newspapers and its opinions.
Activities: this course is mostly activity based. Students will often be engaged in interactive discussion. The tasks and activities include pair work, group work, brainstorming, guesswork, describing picture/graph/diagrams, word puzzle, making jokes, storytelling, and role play, responding to reading and listening texts. **Cambridge IELTS books.**

Reference Book(s):

1. Jones. L.(1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
2. Dixon, R.J.(1987).Complete course in English.(Book4).New Delhi, India: Prentice Hall of India. (For Book Presentation)
3. S.M. Amanullah- A Guide to Correct Speech, Albatross Publications
4. R.C. Sharma &Krisna Mohan- Business Correspondence and Report Writing, Tata McGraw- Hill Publication Ltd
5. Materials provided by the instructor.
6. Cambridge IELTS Practice book

HUM-1153: Bengali Language and Literature
2 hours in a week, 2.00 Cr.

Pre-requisite: None

Course Content:

প্রথম খন্ড - ভাষা

১. বাংলাধ্বনি/বাগ্‌ধ্বনি (Phone/Speech Sound); বর্ণ (Letter); অক্ষর (Syllable)

২. বাংলা ধ্বনির উচ্চারণ স্থান ও রীতি (Point of Articulation & Manner of Articulation)

৩. বাংলা উচ্চারণ - প্রমিত (Standard), আঞ্চলিক (Dialectal), বৈচিত্র (Variation)

৪. অপিনিহিত, অভিশ্রুতি, স্বরসঙ্গতি, শ্বাসাঘাত (Stress accent), স্বরভঙ্গি/ স্বরতরঙ্গ (Intonation);

৫. বাংলা ও ইংরেজিরতুলনা

৬. বাংলা লিখন দক্ষতা: সাধু/চলিতরীতি। বিরামচিহ্নপ্রয়োগ। প্রমিত বাংলা বানানের নিয়ম (বাংলা একাডেমি)

৭. ব্যবহারিক বাংলা: সংক্ষিপ্ত আলোচনা

একুশে ফেব্রুয়ারী, মুক্তিযুদ্ধ, বাংলা ভাষা, বিশ্বায়ন, বাংলার উৎসব, ষড়ঋতু, বাংলা নববর্ষ, আধুনিক তথ্য-প্রযুক্তি, বাংলার লোকসংস্কৃতি, মানবতা ও নৈতিকতা।

দ্বিতীয় খন্ড - সাহিত্য

কবিতা

১. আবদুল হাকিম - নূরনামা

২. মাইকেল মধূসুদন দত্ত - বঙ্গভাষা

৩. লালন সাইঁ - খাঁচার ভেতরঅচিনপাখি

৪. রবীন্দ্রনাথ ঠাকুর - নির্ঝরের স্বপ্নভঙ্গ

৫. কাজী নজরুল ইসলাম - আজসৃষ্টি -সুখের উল্লাসে

৬. জীবনানন্দ দাস - রূপসী বাংলা

৭. হাসানহাফিজুররহমান - অমর একুশে

৮. আলাউদ্দিন আল আজাদ - স্মৃতি স্তম্ভ

৯. শামসুর রাহমান - তোমাকে পাওয়ার জন্য হে স্বাধীনতা

১০. সৈয়দ শামসুলহক - পরিচয়

প্রবন্ধ

১. বঙ্কিম চন্দ্র চট্টোপাধ্যয়- বাঙ্গালা ভাষা

২. রবীন্দ্রনাথ ঠাকুর- সভ্যতার সংকট

৩. হরপ্রসাদ শাস্ত্রী- তৈল

৪. প্রমথ চৌধুরী- যৌবনে দাও রাজটিকা

৫. কাজীনজরুলইসলাম- বর্তমান বিশ্বসাহিত্য

৬. মুহম্মদ আবদুলহাই- আমাদেও বাংলা উচ্চারণ

৭. কবীর চৌধুরী- আমাদের আত্মপরিচয়

ছোটগল্প ও অন্যান্য রচনা

১. রবীন্দ্রনাথ ঠাকুর- পোস্ট মাস্টার

২. রোকেয়া সাখাওয়াত হোসেন- অবরোধ বাসিনী

৩. বিভূতিভূষণ বন্দোপাধ্যায়- পুঁইমাচা
৪. সৈয়দ ওয়ালীউল্লাহ- নয়নচারা
৫. জাহানারা ইমাম- একাত্তরের দিনগুলি
৬. হাসান আজিজুল হক- ঘর গেরস্থি
৭. আখতারুজ্জামান ইলিয়াস- অপঘাত

নাটক

১. কবর - মুনির চৌধুরী

1st Year 2nd Semester

CSE-1211: Discrete Mathematics
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Mathematical Logic: propositional calculus and predicate calculus, Mathematical reasoning and proof techniques**.**
Set theory: sets, relations, partially ordered sets, functions.
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: Groyas Semi group, Monoid Groups, Abeliangroup, properties of groups, Permutation Groups, Subgroups, Cyclic Group.

Reference Book(s):

1. Discrete Mathematics & Its Applications- Kenneth H Rosen
2. Discrete Mathematics with Applications -Thomas Koshy
3. Combinatorics: Theory and Applications - V. Krishnamurthy, East-West Press.
4. Discrete Mathematics - Seymour Lipschutz, M. Lipson, Tata McGraw-Hill
5. Discrete Mathematical Structures - Kolman, Busby Ross, Prentice Hall International

CSE-1213: Structured Programming
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-1100
Course Content:

Introduction: Programming concepts, Programming and coding; Program development stages; Compilers, interpreters and IDE; Syntax and semantics; Flowcharts.

Structured programming language: Data types, Operators, Expressions, Control structures; Functions and program structure: Function basics, Parameter passing conventions, scope rules and storage classes; Header files, User defined header files; Preprocessor; Pointer and it's uses; Arrays; Multidimensional Arrays; Strings.
User defined data types: Structures, Unions, and Enumerations.
Input and Output: Standard input and output, Formatted input and output, File access; Variable length argument list; Command line parameters; Error Handling; Exception Handling; Linking; Library functions; Type casting; Memory allocation: Static and Dynamic; Recursive Functions;
Introduction to data structure: Stack, Queue; File I/O; Graphics.

Reference Book(s):

1. Teach Yourself C – Herbert Schidlt
2. Programming in ANSI C - E Balagurusamy
3. C: The Complete Reference – Herbert Schildt
4. C Programming Language – Dennis M. Ritche

CSE-1214: Structured Programming Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:

Introduction: Mathematical problems solving, using printf, scanf, Operators, If, Else if, Switch;
Programming loop Concept: Loop, Nested Loop, Function, Recursion;
Arrays: Arrays and Strings, Multidimensional Array and Pointers,
User Defined Data Types: Structures, Unions, Enumerations,
Advanced Topics: File I/O, Header files, Preprocessor. Bitwise Operations & Dynamic memory allocation.

Reference Book(s):

1. Teach Yourself C – Herbert Schidlt
2. Programming in ANSI C - E Balagurusamy
3. C: The Complete Reference – Herbert Schildt
4. C Programming Language – Dennis M. Ritche

EEE-1261: Electrical Circuit Analysis
3 hours/week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: 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).

Reference Book (s):

1. Introductory Circuit Analysis (12th Ed) - Robert L. Boylestad, Pearson Education India (2013).
2. Alternating Current Circuits (3rd Ed) - Russel M Kerchner and George FCorcoran, J. Wiley & Sons Inc. (1951).
3. Fundamentals of Electric Circuits (6th ed) - Charles K Alexander, Mathew N O Sadiku, McGraw-Hill Education (2016).
4. Introduction to Electric Circuits (6th Ed) - Richard C. Dorf, James A. Svoboda, Wiley (2013).

EEE-1262: Electrical Circuit Analysis Sessional

3 hours/week, 1.50 Cr.

Pre-requisite: None

Course Content:

Dc Circuit analysis: Construction and operation of simple electrical circuits, verification of KVL, verification of KCL, verification of superposition principle, verification of Thevenin's theorem.

Ac Circuit Analysis: Familiarization with Alternating Current (Ac) waves, study of R-L-C series circuit, different types of filters and its characteristics with different input frequency, series resonance and parallel resonance.

Reference Book (s):

1. Introductory Circuit Analysis (12th Ed) - Robert L. Boylestad, Pearson Education India (2013).

2. Alternating Current Circuits (3rd Ed) - Russel M Kerchner and George FCorcoran, J. Wiley & Sons Inc. (1951).
3. Fundamentals of Electric Circuits (6th Ed) - Charles K Alexander, Mathew N O Sadiku, McGraw-Hill Education (2016).
4. Introduction to Electric Circuits (6th Ed) - Richard C. Dorf, James A. Svoboda, Wiley (2013).

CE-1270: Engineering Drawing & CAD Sessional
1.5 hours in a week, 0.75Cr.

Pre-requisite: None

Course Content:

Introduction: Engineering Drawing & CAD Sessional Introduction.
Lettering &numbering: Lettering, Numbering and Heading, Instrument and their use.
Isometric view: Sectional views and isometric views of solid geometrical figure, Plan, Elevation and Section of one-story building.
Detailed drawing: Building service drawing (Electrical layout and Plumbing), Detailed drawing of lattice towers, Use of AutoCAD software.

Reference Book(s):

1. Prathomik Engineering Drawing - Hemanta Kumar Bhattacharyya.

CHEM-1203: Inorganic and Physical Chemistry

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Atomic structure: Nuclear charge, various atomic models, Spectrum, Quantum number, Orbit and Orbital, Various principles of electronic configuration.
Chemical bonds: Various types of bonds, VSEPR theory, lattice and formation energy, Bond order.
Oxidation-Reduction: REDOX reaction, Oxidation number, Electromotive force (EMF), Balancing REDOX reaction.
Modern Periodic Table: Ionization potential, Electron affinity, Electronegativity, Transition elements, Inert gases, Lanthanides and actinides.
Acids and Bases: Theories and modern definition of acid and bases, Dissociation constant, Strength, pH, Buffer solution.
Electrochemistry: Conductors, Degree of ionizations, Faraday's law, Kohlrausch law, Transport number.

Chemical Equilibria: Types of chemical equilibrium, Law of mass action, Kp, Kc and Kx, Le-Chatelier's principle.
Thermodynamics and Thermochemistry: Thermodynamical terms, Thermodynamical processes, First law of Thermodynamics, Enthalpy, Heat capacity, Joule-Thomson effect, Thermochemistry, Thermochemical law.
Solutions: Types of solutions, Henry's law, Nernst distribution law, Raoult's law, Osmosis and osmotic pressure.
Liquid state: Vapor pressure, Surface tension and viscosity, Refractive index, Optical activity.

Reference Book(s):

1. Introduction to Modern Inorganic Chemistry- S. Z. Haider.
2. Modern Inorganic Chemistry- R. D. Madan.
3. Fundamental concepts of Inorganic Chemistry- S. Gilreath.
4. Advanced Inorganic Chemistry- S. Prakash& G. Tuli.
5. Essentials of Physical Chemistry- B. S. Bahl and G. D. Tuli.
6. Principle of Physical chemistry- M. M. Haque and M. A. Nawab.
7. A text book of Physical Chemistry- S Glasstone
8. Essentials of Physical Chemistry- B. S. Bahl and G. D. Tuli.

CHEM-1204: Inorganic and Physical Chemistry Sessional
1.5 hours in a week, 0.75Cr.

Pre-requisite: None
Course Content:

Volumetric Analysis: Acidimetry-alkalimetry, titrations involving redox reactions.
Quantitative analysis: Determination of Cu, Fe and Ca volumetrically, determination of Ca and Mg in water.

Reference Book(s):

1. Inorganic Quantitative Analysis- AI Vogel
2. Analytical Chemistry- Verma

MATH-1243: Ordinary and Partial Differential Equations and Coordinate Geometry
3 hours in a week, 3.00Cr.

Pre-requisite: None

Course Content:

Ordinary Differential Equations: Introduction to differential equations, formulation of differential equations, solution of first order differential equations by various methods, solution of differential equation of first order but higher degrees, solution of general linear equations of second and higher orders with constant co-efficient, solution of Euler's homogeneous linear differential equations, application of ODE.

Partial Differential Equations: Introduction, linear and nonlinear first order differential equations, standard forms, linear equations of higher order, equation of second order with constant coefficients, equation of second order with variable coefficients, application of PDE(heat equation, wave equation, Laplace equation).

Coordinate Geometry: Introduction to geometry, transformation of coordinates, pair of straight lines, general equation of second degree and reduction to its standard forms and find the properties.

Reference Book(s):

1. Ordinary and Partial Differential Equations -Raisinghania.
2. A Text Book on Co-ordinate Geometry with Vector Analysis – Rahman & Bhattacharjee.
3. Differential Equations with Applications-M. M. K. Chowdhury
4. Differential Equations- S.L. Ross
5. Differential Equations- Frank Ayres
6. Differential Equations-Dr. B.D. Sharma
7. Differential Equations, Jai prakashan-M. L. Khanna
8. Partial Differential Equations, McGraw-Hill- Bernard Epstein
9. The elements of coordinate geometry-S. L. Loney.

HUM-1255: Bangladesh Studies (History of Independence)
2 hours in a week, 2.00 Cr.

Pre-requisite: None

Course Content:

Pre-Independence Period: Ancient period and Muslim period of Bengal, British period, Pakistan period: an overview (1952-1971), Language Movement, Six-point Movement, Mass Revolution, and General Election 1970.

History of Bangladesh period: The problem of national integration under Ayub regime, Elite in crisis during Pakistan rule, nation-building in the new state, The ideals and philosophy of constitution- making of Bangladesh, Study on the coup and assassination of Bangabandhu Sheikh Mujib, Philosophy and fundamental changes of Zia regime, Constitutional amendments of Bangladesh, Corruption and good governance in Bangladesh, Issues of governance of Bangladesh, Bangladesh economy, Ideas on political and ethnic conflict in Bangladesh, Geographical setting of Bangladesh, environmental challenges of Bangladesh, Bangladesh foreign policy: realities and challenges, Foreign policy-decision-making process in Bangladesh.

Reference Book(s):

1. "Bangladesh in International Politics" - Muhammad Shamsul Huq (1995), the University Press Limited, Dhaka-1000.
2. "Constitution, Constitutional Law and Politics: Bangladesh Perspective"- Md. Abdul Halim, CCB Foundation, Dhaka-1000.
3. "Bangladesh in the Twenty-First Century: Towards an Industrial Society" - A M A Muhith (1999), the University Press Limited, Dhaka-1000.
4. "Bangladesh Foreign Policy: Realities, Priorities and Challenges" – Harun ur Rashid (2012, 2nd Edition), Academic Press and Publishers Library, Dhaka-1209.
5. "The Changing Pattern of Bangladesh Foreign Policy: A Comparative Study of Mujib and Zia Regimes" – Zaglul Haider (2008), The University Press Limited, Dhaka-1000
6. Bangladesh Studies and Culture- Sumon Das & M.N. Mohabbat, Human Publications
7. History of Emergence of Bangladesh-Muntasir Mamun & Mahbubur Rahman, UGC

2nd Year 1st Semester
CSE-2101: Digital Logic Design
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-1101

Course Content:

Fundamentals of Digital Logic System: Number systems, Weighted and non-weighted codes, Error detection code, Binary addition and subtraction, 2's complement method.
Logic Gates and Boolean algebra: Logic Circuit Design, Adder, Subtractor.
Minimization Technique: Algebraic Simplification, Karnaugh Map method, Quine-McClusky method, consensus method.
Switching Devices, Switching Characteristics of Diodes: Transistors and FETs.
Integrated Circuit Logic Families: DTL and TTL logic family, standard TTL series characteristics, other TTL series, TTL loading rules, TTL open-collector outputs, tristate TTL.
Flip-Flops (FF) and Related Devices: Transistor Latch, NAND gate Latch, NOR gate latch, D latch.
Clock Signals and Clocked FFs: Clocked SR, JK and D Flip-flops, Master –slave JK FF, Timing diagram of different FFS, Edge-triggered and Level-triggered timing diagram.
555 Timer: Architecture of 555 timer, different application of 555 timer,555 as a Monostable, Bistable and Astable multivibrators.
A/D and D/A Converter: Sample and Hold Circuit, Weighted resistor and R-2R ladder D/A converters, Specifications for D/A converters. A/D converters, quantization, parallel

comparator, successive approximation, and counting type, dual –slope ADC, Specifications of ADC.

Reference Book(s):

1. Digital Logic and Computer Design (4th ed) - M. Morris Manno (2007)
2. Digital Systems: Principles and Applications, Prentice Hall-Ronald J. Tocci
3. Digital Computer Electronics (3th ed) - Albert P. Malvino, Jerald A Brown (2001)

CSE-2102: Digital Logic Design Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Fundamentals: Digital Logic System, Logic Gates and Boolean algebra.
Minimization Technique: Algebraic Simplification, Karnaugh Map method.
Switching Devices, Switching Characteristics of Diodes: Switching Devices, Switching Characteristics of Diodes, Transistors and FETs.
A/D and D/A Converter: Sample and Hold Circuit, Weighted resistor and R-2R ladder D/A converters.
Integrated Circuit Logic Families: Flip-Flops (FF) and Related Devices, Clock Signals and Clocked FFs, 555 Timer, A/D and D/A Converter.

Reference Book(s):

1. Digital Logic and Computer Design-M. Morris Manno
2. Digital Computer Electronics - Albert P. Malvino, Jerald A Brown

CSE-2103: Data Structures and Algorithms-I
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-1213

Course Content:

Introduction: Internal data representation; Abstract data types; Introduction to algorithms.
Asymptotic analysis: Growth of functions, O, Ω and Θ notations; Correctness proof and techniques for analysis of algorithms; Master Theorem.
Elementary data structures: Arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search trees.
Graph Traversals: DFS, BFS, Applications of DFS and BFS.
Sorting: heapsort, merge sort, quicksort; Data structures for set operations.

Methods for the design of efficient algorithms: Divide and conquer, greedy methods, dynamic programming.

Reference Book(s):

1. Classic Data Structures 2nd Ed – Debasis Samanta.
2. Data Structures using C 2nd Ed – Aaron M. Tenenbaum, YedidyahLangsam, Moshe J. Augenstein.
3. Data Structures (Schaum's Outline Series), Tata McGraw-Hill- Seymour Lipshultz.

CSE-2104: Data Structures and Algorithms-I Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:

Introduction: Implementation of Abstract data types; Introduction to algorithms.
Asymptotic analysis: Growth of functions, O, Ω and Θ notations; Correctness proof and techniques for analysis of algorithms; Master Theorem.
Elementary data structures: Arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search trees.
Graph Traversals: DFS, BFS, Applications of DFS and BFS.
Sorting: Heapsort, merge sort, quicksort; Data structures for set operations;
Methods for the design of efficient algorithms: divide and conquer, greedy methods, dynamic programming.

Reference Book(s):

1. Classic Data Structures 2nd Ed – Debasis Samanta
2. Data Structures using C 2nd Ed Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J.Augenstein
3. Data Structures (Schaum's Outline Series), Tata McGraw-Hill- Seymour Lipshultz

CSE-2105: Object Oriented Programming
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-1213

Course Content:

Introduction: Object oriented programming and procedural oriented programming, encapsulation, inheritance, polymorphism, data abstraction, data binding, static and dynamic binding, message passing.

C++ as an Object-Oriented Language: Declaration and constants, expression and statements, data types, operator, functions.
Classes: Structure of classless, public, private and protected members, array of object, argumented member function, and non-augmented objects, nested member class and their object, pointer objects and pointer members, object argument of function, static class member and static class, friend function, friend class.
Constructor and Destructors: Default constructor, argumented constructor, copy constructor, dynamic constructor, constructor function for derived class and their order of execution, destructor.
Inheritance: Mode of inheritance, classifications of inheritance, virtual inheritance, array of objects of derived class.
Polymorphism: Operator and function overloading, run-time and compile time polymorphism, object pointer and pointer to an object, function overriding and dynamic binding.
C++ Data File: C++ file stream classes, input and output file, mode of files, file pointer, random files accessing.
Template and Exception Handling: Function template and class template, exception handling, concept of namespaces, overview of standard template library (vectors & iterators), multi-threaded programming.

Reference Book(s):

1. C++: The Complete Reference - Herbert Schildt
2. Object Oriented Programming with C++ - Balaguruswamy, McGraw Hill Publications.
3. Object-Oriented Programming in C++ - Robert Lafore, SAMS Publications

CSE-2106: Object Oriented Programming Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:

Basic OOP: Classes and objects, encapsulation, 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, static functions.
Inheritance: single and multiple inheritance.

Polymorphism: overloading, abstract classes, virtual functions and overriding.
Others: Exception Handling; Object Oriented I/O; Template functions and classes; Concept of Namespaces, Overview of Standard Template Library (Vectors & Iterators); Multi-threaded Programming, Abstract Data Types.

Reference Book(s):

1. Teach Yourself C++ by Herbert Schildt
2. Object Oriented Programming with C++ by E Balagurusamy
3. Complete Reference C++ by Herbert Schildt
4. Programming with C++ by Schaums Outline Series

EEE-2163: Electronic Devices and Circuits
3 hours in a week, 3.00 Cr.

Pre-requisite: EEE-1261

Course Content:

Basic concept of Semiconductor: Introduction to semiconductors.
Diode and its applications: P-n junction diode, I–V characteristics; Diode applications: half and full wave rectifiers, clipping and clamping circuits, regulated power supply.
Transistor (BJT): 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.
Op Amps: Operational amplifiers (Op Amps) and its applications.
Oscilators: Feedback and oscillators circuits.
Fabrication of IC: Introduction to Integrated Circuit (IC) fabrication processes.

Reference Book(s):

1. Electronic Devices and Circuit Theory -Robert L. Boylestad and Louis Nashelsky
2. Electronic Principles – Albert P.Malvino.
3. Micro Electronics Circuits-Adel S. Sedra & Keneth C. Smith-Oxford University Press
4. Operation Amplifiers and Linear Integrated Circuits-Robert F. Coughlin-Prentice Hall of India Private Limited

EEE-2164: Electronic Devices and Circuits Sessional
1.50 Hours in a week, 0.75Cr.

Pre-requisite: None
Course Content:

Analysis of diode operation and its applications: Study of Diode Characteristics, Study of Diode Rectifier.
Biasing and operation of BJT: Study of N-P-N CB (Common Base) Transistor Characteristics, Study of N-P-N CE (Common Emitter) Transistor Characteristics, Study of BJT Biasing Circuits.
FET: Study the Characteristics of Junction Field Effect Transistor (JFET).
Operation and application of OP-Amp: Mathematical Operations Using Op-Amp.
Silicon Control Rectifier: SCR Operation Characteristic in DC Circuits.

Reference Book(s):

1. Electronic Devices and Circuit Theory -Robert L. Boylestad and Louis Nashelsky.
2. Electronic Principles – Albert P. Malvino.
3. Micro Electronics Circuits-Adel S. Sedra & Keneth C. Smith-Oxford University Press.
4. Operation Amplifiers and Linear Integrated Circuits-Robert F. Coughlin-Prentice Hall of India Private Limited.

MATH-2145: Vector Analysis, Matrices and Fourier Analysis
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Vector Analysis: Scalars and vectors, equality of vectors, addition and subtraction of vectors, multiplication of vectors by scalars, scalar and vector product of two vectors and their geometrical interpretation, triple products and multiple products, linear dependence and independence of vectors, differentiation and integration of vectors along with elementary applications, vector geometry, gradient, divergence and curl of point functions, definition of line, surface and volume integrals, Green's theorem, divergence theorem of Gauss's, Stoke's theorem and their applications.

Matrices: Definition of matrix, algebra of matrices, transpose of a matrix, inverse of matrix, rank and elementary transformations of matrices, solution of linear equations, linear dependence and independence of vectors, quadratic forms, matrix polynomials, determination of characteristic root and vectors, Cayley-Hamilton theorem and it's application, null space and nullity of matrix, characteristic subspace of matrix.

Fourier Analysis: Real and complex form of Fourier series, finite transform, Fourier integral, Fourier transforms, inverse Fourier transforms and their uses in solving boundary value problems.

Reference Book(s):

1. Vector Analysis - Seymour Lipschutz, Dennis Spellman and Murray R. Spiegel, Schaum's outlines
2. Vector Analysis - M. D. Raisinghania
3. Elementary Linear algebra - Wiely, Howard Anton and Chris Rorres
4. Schaum's Outline of Theory and Problems of Matrices, McGraw-Hill-Frank Ayres, Jr
5. Matrices- M.L. Khanna
6. Mathematical Methods- Prof. Abdur Rahman
7. Schaum's Outline of Fourier Analysis with Applications to Boundary Value Problems, McGraw-Hill-Murray R. Spiegel

8. Fourier Series and Boundary Value Problems- Ruel V. Churchill and James Ward Brown

2nd Year 2nd Semester

CSE-2211: Database Management Systems

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

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

Reference Book(s):

1. Database System Concept- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Fourth edition
2. Files and Databases- An Introduction, Peter D. Smith and G.M. Barnes, Addison-Wesley
3. Database Management Systems- Raghu Ramakrishnan and Johannes Gehrke, Third edition

CSE-2212: Database Management Systems Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:
Introduction: Oracle Installation, Authentication, Security.
SQL basics: Table Creation, SQL, Simple Query, Data Expressions, Join, Constraints, Advanced Query (GROUP Function etc.), Sub- queries.
Advanced Topics: Single-row function, Numeric function, Manipulation function, Conversion function, Indexing, View.

Introduction to PL/SQL: Nesting of function, Abstract data type, Database Trigger/ Procedure, PL/SQL Packages.

Reference Book(s):

1. Database System Concept, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Fourth edition
2. The Complete Reference JAVA2, Herbert Schildt
3. Microsoft C# Professional Projects, Geetanjali Arora, B. Aiaswamy, Nitin Pandey
4. The Complete Reference PHP 5.2 Steven Holzner
5. SQL PL/SQL-The Programming Language Oracle, Ivan Byross

CSE-2213: Data Structures and Algorithms –II
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-2103

Course Content:

Graph algorithms: MST algorithms, shortest path algorithms, maximum flow and maximum bipartite matching; Lower bound theory.
Advanced data Structures: balanced binary search trees (AVL trees, redblack trees, splay trees, skip lists), advanced heaps (Fibonacci heaps, binomial heaps); Hashing; NP completeness; NP-hard and NP-complete problems; coping with hardness: backtracking, branch and bound, approximation algorithms; String matching algorithms; FFT and its applications.

Reference Book(s):

1. Data Structures – Edward Martin Reingold; Wilfred J. Hansen(2011)
2. Data structures and algorithm (1st ed) – John E. Hopcroft; Jeffrey D. Ullman(1983)
3. Data Structures and Algorithms in Java (4th ed) - Michael T. Goodrich; Roberto Tamassia (2005)
4. Introduction to Algorithms (3rd ed) - T. H. Cormen; C. E. Leiserson; R. L. Rivest; C. Stein, MIT Press(2009)
5. Algorithm Design (1st ed) - J. Kleinberg; E. Tardos(2005)
6. Algorithm Design and Applications (1st ed) - Michael T. Goodrich; Roberto Tamassia, Wiley(2014)

CSE-2214: Data Structures and Algorithms-II Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: None
Course Content:

Implementation of Graph algorithms: MST algorithms, shortest path algorithms, maximum flow and maximum bipartite matching; Lower bound theory.
Advanced data Structures: balanced binary search trees (AVL trees, redblack trees, splay trees, skip lists), advanced heaps (Fibonacci heaps, binomial heaps); Hashing; NP completeness; NP-hard and NP-complete problems; coping with hardness: backtracking, branch and bound, approximation algorithms; String matching algorithms; FFT and its applications.
Reference Book(s):

1. Introduction to Algorithms (3rd ed) – Thomas H. Cormen; Charles E. Leiserson; Ronald L. Rivest; Clifford Stein (2017)

CSE-2215: Digital Electronics and Pulse Technique
3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:
Introduction of logic gates: Diode Logic Gates, Transistor Switches, Transistor Gates, Open Collector and High Impedance Gates, MOS Gates; Digital Logic Families: TTL, ECL, IIL and CMOS Logic with Operation Details.
Characteristics of Digital ICs: Propagation delay, Power dissipation, Figure of Merit, Fan out, and Noise immunity.
Sequential Logic Circuit: Electronic Circuits for Flip Flops, Counters and Register, Memory Systems, PLAs.
Converter: S/H circuits, A/D and D/A Converters with Applications.
Different pulse Techniques: Linear Wave Shaping, Diode Wave Shaping Techniques, Comparator Circuits,
Switching Circuits: Pulse Transformers, Pulse Transmission and Pulse Generation.
Trigger circuits: Monostable, Bi-stable and A stable Multivibrator; Schmitt Trigger.
Couple oscillator Circuits: Optically Coupled Oscillators; Blocking Oscillators and Time-base Circuit.
Timing circuits: Simple voltage sweeps, linear current sweeps.

Reference Book(s):

1. Pulse, Digital and Switching waveforms- Jacob Millman and Herbert Taub.
2. Microelectronics: Digital and Analog Circuits and Systems- Jacob Millman.
3. Operational Amplifier and Linear Integrated Circuits- Robert Coughlin.

CSE-2216: Digital Electronics and Pulse Technique Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Combinational and Sequential Circuits: Fundamental concepts of the physical operation, analysis and design of digital integrated circuits and systems.
Pulse Technique: Understanding the different techniques of Digital Electronics and Pulse in practical and practice.
Switching Circuits: Comparison and analyzation of diodes, transistors as switching circuits.

Reference Book(s):

1. Modern Digital Electronics (4th ed) - R. P. Jain (2018)
2. Pulse, Digital And Switching Waveforms (3rd ed) - Millman& J Taub H(2017)
3. Solid State Pulse Circuits (4th ed) - David A. Bell (2007)

CSE-2218: Advanced Programming Sessional
3.00 hours in a week, 1.5 Cr.

Pre-requisite: CSE-2105

Course Content:

Philosophy of JAVA; Advantages of JAVA over C++ and 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; Inheritance: single and multiple inheritance;
Polymorphism: overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; Template functions and classes; Multi-threaded Programming, Project Work.

Reference Book(s):

1. Java, The Complete Reference (9th ed) - Herbert Schildt

EEE-2265: Electrical Drives and Instrumentation
3 hours in a week, 3.00 Cr.

Pre-requisite: EEE-2163

Course Content:

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.

Reference Book(s):

1. A Text Book of Electrical technology - B.L Theraja
2. Electrical Machinery and Transformers - Irving L. Kossow
3. A Course in Electrical and Electronic Measurements and Instrumentation - A.K. Sawhney
4. Electronic Instrumentation and Measurements - David A. Bel
5. Electrical Machines-Nagrath and Kothari, McGraw Hill
6. Alternating Current Machines-A.F. Puchstein and T.C. Lioyd-John willey and Sons Inc.

EEE-2266: Electrical Drives and Instrumentation Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

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.

Reference Book(s):

1. A Text Book of Electrical technology - B.L Theraja
2. Electrical Machinery and Transformers - Irving L. Kossow
3. A Course in Electrical and Electronic Measurements and Instrumentation - A.K. Sawhney
4. Electronic Instrumentation and Measurements - David A. Bel
5. Electrical Machines-Nagrath and Kothari, McGrawHill
6. Alternating Current Machines-A.F. Puchstein and T.C. Lioyd-John willey and Sons Inc.

MATH-2247: Complex Variable and Laplace Transformation
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Complex Variable: Complex number system, general functions of a complex variable, limits and continuity of functions of complex variables and related theorems, complex differentiation and the Cauchy-Riemann equations, mapping by elementary functions, line integral of complex functions, Cauchy's integral theorem, Cauchy's integral formula, Liouville's theorem, Taylor's theorem and Laurent's theorem, singular points, residues and Cauchy's residue theorem, evaluation of residues, contour integration, conformal mapping.

Laplace Transforms: Definition, Laplace transforms of some elementary functions, sufficient conditions for existence of Laplace transformation, inverse Laplace transforms. Laplace transforms of derivatives, the unit step function, periodic functions, some special theorems on Laplace transforms, partial fraction, solutions of differential equations by Laplace transforms, evaluation of improper integrals.

Reference Book(s):

1. Complex variable (2nd ed) – Schaum's Out-line Series by Spiegel(2009)
2. Complex Analysis – Prof. Haridashalder & Dr. Md. Amirul Islam
3. Schaum's Outline of Theory and Problems of Laplace Transforms - Murray R. Spiegel(1965)
4. Advanced Engineering Mathematics (10th ed) – Erwin Kreyszig
5. Complex Variables and Applications-James Ward Brown and Ruel V. Churchill

3rd Year 1st Semester

CSE-3101: Numerical Analysis

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Approximations and Errors: Accuracy and Precision, Error definitions, Round-off errors, Truncation errors.

Roots of Equations: Graphical methods, The Bisection method, The False-Position method, Simple One-Point iteration, The Newton-Raphson method, The Secant method.

Systems of Linear Algebraic Equations: Gauss elimination, Solving small numbers of equations, Naive gauss elimination, Pitfalls of elimination methods, Matrix inversion and Gauss– Seidel, The Matrix inverse, Error analysis.

Curve Fitting: Linear regression, Polynomial regression, multiple linear regression, Newton's Divided-Difference Interpolating Polynomials.

Numerical Differentiation and Integration: The Trapezoidal rule, Simpson's rules, Integration with unequal segments, Romberg integration, Gauss quadrature, High-accuracy differentiation formulas, Richardson extrapolation, Derivatives of unequally spaced data.

Finite-difference Methods for Ordinary Differential Equations: Stability analysis of finite-difference methods: Euler, backward Euler, midpoint, trapezoidal, midpoint-trapezoidal predictor-corrector, Runge-Kutta methods.

Reference Book(s):

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition.
2. Steven. C Chapra, "Numerical Methods for Engineers, McGraw-Hill.
3. S.S. Kuo, "Computer Applications of Numerical Methods", Addison-Wesely.

CSE-3102: Numerical Analysis Sessional

1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Introduction: Mathematical Model. Sources of errors, their propagation and the idea of conditioning. Solution of algebraic and transcendental equations: Iterative methods for root finding. Rates of convergence.

Roots of Equations: False Position method, Newton-Rhapson method.

Solution of simultaneous linear equations: Gauss-Jordan Elimination method, Choleski's process; Dolittle and Crout factorization; 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 rules, 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.

Reference Book(s):

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition.
2. Steven. C Chapra," Numerical Methods for Engineers, McGraw-Hill
3. S.S. Kuo," Computer Applications of Numerical Methods", Addison-Wesely.

CSE-3103: Software Engineering and Information System Design
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Concepts of software engineering: Software engineering paradigms: Different phases of software.
Design concepts and principles: architectural design, user interface design, object-oriented software development and design, iterative development and the unified process, sequential waterfall life cycles.
UML diagrams: Interaction and Collaboration Diagram for designing Software, class diagram. Structured and non-Structured programming.
Data- directed design techniques: Modular design; Design of automatic, redundant and defensive program; COCOMO model; Tree model; PNR curve; Statistical model.
Software testing: white box and black box testing, basis path testing, testing for specialized environment.
Software testing strategies: Unit testing, integration testing, validation testing, system testing; Art of debugging; Zips Concepts of software reliability and availability; Software repair, downtime, error and faults, specification and correction; New error generation hypothesis; Estimating number of bugs in a computer program; Reliability. Models; Availability models; Quality assurance; Quality measures; Different cost estimation models and their comparisons; Software maintenance; Maintenance-cost models: Growth dynamic models; Documentation; Software project organization; Management and communication skills.

Information Management: Different types of information; Qualities of information; Analysis of Information requirements for modern organizations; Role, tasks and attributes of a Systems Analyst; Sources of information; Information gathering techniques; Editing; Handling of missing information; Requirement's specifications; Steps of systems analysis.

Concepts of feasibility analysis: Analysis of technical facilities; Cost-benefit analysis; Design of an information system; Design Patterns; Hardware and software analysis.

Introduction to IT project management: Estimation of confidence level: Simplex method for minimization of project time; project team organization, IT Adoption and Diffusion theories; Ethics and privacy: Control and security.

Reference Book(s):

1. Software Engineering BY Ian Sommerville.
2. Software Engineering- a practitioner's Approach BY Roger S. Pressman.
3. Software Engineering: Principles and Practice BY Hans van Vliet.
4. System Analysis and Design (2nd Edition) - Elias M. Awad; Galgotia Publications Pvt. Ltd. (2010).
5. System Analysis and Design (2nd Edition) - Raja Raman; Prentice Hall (2004).
6. System Analysis and Design Methods (7th Edition) - Jeffery L. Whitten; McGraw Hill (2007).
7. System Analysis and Design (9th Edition) – Kendel & Kendel; Pearson (2013).

CSE-3104: Software Engineering and Information System Design Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Introduction: Analysis of Information requirements for modern organizations; Information gathering techniques; Editing; Handling of missing information; Requirement's specifications; Steps of systems analysis.
Concepts of feasibility analysis: Analysis of technical facilities; Cost-benefit analysis; Design of an information system; Design Patterns; Hardware and software analysis.
Introduction to IT project management: Estimation of confidence level: Simplex method for minimization of project time; project team organization, IT Adoption and Diffusion theories.
Ethics and privacy: Control and security.

Reference Book(s):

1. Software Engineering- a practitioner's Approach BY Roger S. Pressman.
2. System Analysis and Design (2nd Edition) - Elias M. Awad; Galgotia Publications Pvt. Ltd.(2010).
3. System Analysis and Design (2nd Edition) - Raja Raman; Prentice Hall (2004).

CSE-3105: Data and Telecommunication

3 hours in a week, 3.00Cr.

Pre-requisite: None
Course Content:

Data Communication: Communication models, data communication tasks, data communication network standards and organization introduction to TCP/IP models. Data Transmission basics: Analog and digital data, spectrum and bandwidth, Transmission impairments, data rate, and channel capacity. Data Encoding, NRZI Manchester and Differential Manchester encoding, ASK, FSK, PSK, QPSK, QAM encoding, speared spectrum technique, Sampling theorem and pulse code modulation techniques and speech digitization.
Data Transmission: Asynchronous and synchronous data transmission techniques, error, detection techniques, parity cheeks and CRC error correction and hamming code interfacing and EIA 232D or RS 232c.
Data Link Control: Line configurations. Multiplexing: Frequency division multiplexing, international FDM carrier standards, Synchronous time division multiplexing, international TDM carrier standards, statistical time division multiplexing, SONET and SDH.
Telecommunication: overview of telecommunication; history, evolution, convergence of telecommunication and data networks; National and International regulatory bodies.
Basic elements of Telecommunication: Telephone apparatus, microphone, speaker, ringer, pulse and tone dialing mechanism; local and central batteries and advanced systems of power supplies; VSAT; Telephone operating principles: telephone equipment, description of the modern phone.
Telephone switching systems: PSTN, PBX, standards.
Basics of communication systems: modulation, multiplexing; Switching system: circuit switching, packet switching; Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing; integrated services digital network (ISDN), Digital subscriber loop (DSL).
Data communication equipment: Tele-Traffic analysis; Cellular telephony: Frequency reuse, frequency management, channel alignment, handoff strategies, CDMA and GSM, Introduction to satellite communication, Optical fiber communication, Submarine cables, Digital Radio Microwave, etc.

Reference Book(s):

1. Data Communication and Networking (4th ed) - Behrouz A Forouzan (2017).
2. Data and Computer Communication - William Stallings.
3. Data Communication & Networks – R L Brewster.
4. Introduction to Telecommunication: Voice, Data and the Internet (1st Edition) – Marion Cole; Prentice Hall (2010).
5. Modern Digital and Analog Communication System (4th Edition) – B P Lathi; Oxford (2011)

CSE-3106: Data and Telecommunication Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Introduction to MATLAB / Delta Modulation, AM/FM / AM Modulator & Demodulator, Digital to digital Conversion; Line Coding / DSB-SC and SSB Demodulators, FM Modulator and Demodulator, ASK/PSK/FSK, CDMA, Checksum.

Reference Book(s):

1. Data Communication and Networking (4th Ed) - Behrouz A Forouzan (2017).
2. Data and Computer Communication - William Stallings.
3. Data Communication & Networks – R L Brewster.

CSE-3107: Operating System

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: 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 time sharing.
Memory management: swapping, memory allocation schemes, Paging and segmentation, virtual memory, page replacement strategies, working sets, demand paging.
Deadlock: resource allocation, detection, prevention, avoidance and recovery.
Virtualization: Types and techniques for efficient virtualization, memory and i/o virtualizations, virtual appliances, **Cloud:** clouds as a service, virtual machine migration, Check pointing; Multiple Processor Systems: Multiprocessor, Multicomputer, Distributed Systems, Research on Multiple Processor Systems; Operating system security and protection; case study of some operating systems.
Disk and File management: hardware/software, disk, disk scheduling algorithms, Secondary storage management, terminals, clocks.

Reference Book(s):

1. Modern Operating Systems (4th Ed) - Andrew S. Tanenbaum; Prentice Hall(2014).
2. Operating Systems Concepts, Wiley Publisher- Abraham Silberschatz and Peter Baer Galvin.
3. Operating systems, McGraw-Hill- Madnick and J. Donovon.

4. UNIX System Programming in C++, Prentice Hall Publication- Terrence.

CSE-3108: Operating System Sessional
3.00 hours in a week, 1.50 Cr

Pre-requisite: None

Course Content:

Introduction: Linux Operating System, Installation of Linux in various modes, Installation of windows application programs on Linux, Installation of Linux application programs on Windows +Linux Kernels and Office Environments, Orientation with, Making own kernel, Harding Windows, Harding Linux.
Advanced Topics: Implementation of different algorithms of OS, Basic Command Line commands, Shell Programing

Reference Book(s):

1. Modern Operating Systems (4th Ed) - Andrew S. Tanenbaum; Prentice Hall (2014).
2. "UNIX Shell Programming" – Kanetkar.

CSE-3110: Web Programming Sessional
3.00 hours in a week, 1.50 Cr.

Pre-requisite: None

Course Content:

Introduction: Internet, History of the TCT/IP protocol, World Wide 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.

Webservices: SOAP, WSDL (Web Service Description Language), XML-RPC protocol; configuration, maintenance, monitoring and security.

Reference Book(s):

1. HTML 5 Black Book: Kogent Learning solutions.
2. "Learning PHP 5", David Sklar, O'Reilly Publication.
3. Rich Internet Application AJAX and Beyond WROX press.
4. Responsive Web Design with HTML5 and CSS3, Ben Frain, PACKT Publication.
5. "Web Technologies: Black Book", Dreamtech publication.
6. HTML5 Cookbook, By Christopher Schmitt, Kyle Simpson, O'Reilly Media.

7. Core Python Applications Programming by Wesley J Chun Third edition Pearson Publication.

HUM-3157: Professional Ethics and Environmental Protection
3.00 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Engineering Ethics: Introduction to Ethics. Theories of Ethics. Principles of Engineering Ethics.
Ethical expectation: Employers and employees, inter-professional relationship.
Standards and codes: Fundamental Canons, NSPE codes, IEEE codes of conduct, ACM codes; Institutionalization of ethical conduct. Ethical Dilemmas, Choices (Whistle Blowing).
Computer Ethics: Computer Crime and Cyber Security, Privacy and Confidentiality issue in CSE, Legal Framework in CSE-Copyright laws, ICT Act, Right to Information (RTI), Patents, and Royalty etc. Ethical Challenges for CSE Engineers with the advancement of Technology; Case studies related to ethical issues in ICT and other Engineering disciplines.
Engineering Ethics and professionalism: Responsible Professionals, Professions, and Corporations, The Origins of Ethical Thought, Ethics and the Law, Moral Reasoning and Codes of Ethics: Ethical decision-making strategies, Ethical dilemmas, Codes of ethics, Case studies.
Moral Frameworks for Engineering Ethics: Ethical theories.
Environmental Protection: Sustainable development, environment and natural resources, global environmental problems, environmental ethics, Atmosphere; pollution, solution and prevention, Environmental policy and environmental protection tools, Waste; problems and its solution, voluntary tools in the environmental protection.

Reference Book(s):

1. Charles B. Fleddermann, “Engineering Ethics”, Fourth Edition, 2012.
2. Mike W. Martin, Roland Schinzinger, “Introduction to Engineering Ethics”, Second Edition, 2010.
3. Introduction to Engineering Ethics (3rd Edition) - Schinzinger and Martin; McGraw Hill.
4. Environmental Engineering: Principles and Practice – Wiley.

3rd Year 2nd Semester

CSE-3200: Integrated Design Project / Capstone Project

1.5 hours in a week, 0.75 Cr.

Pre-requisite: CSE-1213, CSE-1214, CSE-2103, CSE-2104, CSE-2105, CSE-2106, CSE-2213, CSE-2214, CSE-2218.

Course Content:

Knowledge Acquisition: Introduction and brief with software, Discussion and submission Project Proposal, Learning Version Control System: Github, Interface design, Database Connectivity: Sqlite, Json, Cloud, Firebase database, Google API, Sensor.
Implementation: Idea Submission, Objective, Methodology, Literature Review, High Level Design, Low-level Design, Evaluation and feedback, Design & Partial Implementation (Prototype/Demo).

Reference Book(s):

1. Android Programming: The Big Nerd Ranch Guide (3rd Edition) (Big Nerd Ranch Guides) 3rd Edition.
2. Professional Android, Reto Meier, Ian Lake; 4thEdition.
3. Website: https://www.tutorialspoint.com/android/.

CSE-3211: Computer Network

3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-3105

Course Content:

Fundamentals & Link Layer: Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance; Link layer Services - Framing - Error Detection - Flow control.
Media Access &Internetworking: Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP) ROUTING**:** Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM).
Transport Layer: Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DEC bit, RED) – QoS – Application requirements.
Application Layer: Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP.

Reference Book(s):

1. Computer Networks - Andrew S. Tanenbaum.
2. Computer Networks: Protocols, Standards, and Interfaces - Uyless Black Internetworking with TCP/IP: Principles, Protocols, And Architecture - D. E. Comer.
3. TCP/IP Illustrated Vol. I - W. R. Stevens.
4. Complete Networking: A Top-down Approach Featuring the Internet – James F. Kurose, Keith W. Ross.

CSE-3212: Computer Network Sessional
3 hours in a week, 1.50 Cr.

Pre-requisite: CSE-3105: Data and Telecommunication.

Course Content:

Basic IP Addressing: Basic Configuration of Cisco Packet Tracer, Basic Network Configuration (Static) Data.
IP protocols: Variable Length Subnet Mask (VLSM), RIP, EIGRP, Dynamic Host Configuration Protocol (DHCP), Open Shortest Path First (OSPF).
Advanced Topics: Physical Network Interface Connection/ Router & Switch Configuration, Access Control List (ACL), VLAN, Inter VLAN, VTP and Introduction to NS2, Socket Programing.

Reference Book(s):

1. Computer Networks - Andrew S. Tanenbaum.
2. Computer Networks: Protocols, Standards, and Interfaces - Uyless Black Internetworking with TCP/IP: Principles, Protocols, Architecture - D. E. Comer.
3. TCP/IP Illustrated Vol. I - W. R. Stevens.
4. Complete Networking: A Top-Down Approach Featuring the Internet – James F. Kurose, Keith W. Ross

CSE-3213: Computer Architecture
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-2101

Course Content:

Fundamentals of Computer Design: computer Design; Processor Design; Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Computer

functions and Interconnection Structures; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU.

Processor design: data paths-single cycle and multi cycle implementations; Control Unit design hardwired and microprogrammed; Hazards; Exceptions; Pipeline: pipelined data path and control, superscalar and dynamic pipelining; RISC Processor, Memory organization: cache, virtual memory, channels; Concepts of DMA and Interrupts; Buses: overview of computer BUS standards.

Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

Digital system: Digital system design Hierarchy; ASM charts; Hardware description language; Design using MSI and LSI components; Combinational and sequential circuit design with PLA's, Design of memory subsystem using SRAM and DRAM.

Reference Book(s):

1. Computer Organization and Architecture - William Stalling.
2. Computer Organization and Design - David A Patterson.
3. Structured Computer Organization - Andrew S. Tanenbaum.
4. Computer Architecture and Organization, McGraw-Hill- John P. Hayes.
5. Computer Organization, McGraw-Hill- Carl Hamacher, Zvonko Vranesic and Safwat Zaky.

CSE-3215: Digital Image Processing

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction and Fundamental to Digital Image Processing: What is digital image processing, origin of digital image processing, examples that use digital image processing, fundamental steps in digital image processing, components of digital image processing system, image sensing and acquisition, image sampling, quantization and representation, basic relationship between pixels.

Image Enhancement in the Spatial Domain & Frequency Domain: Background, basic gray level transformation, histogram processing, basics of spatial filtering, smoothing and sharpening spatial filters, introduction to Fourier transform and the frequency domain, discrete Fourier transform, smoothing and sharpening frequency-domain filters.

Image Restoration: Image degradation/restoration process, noise models, restoration in presence of noise, inverse filtering, minimum mean square filtering, geometric mean filter, geometric transformations.

Color Image Processing: Color fundamentals, color models, basis of full color image processing, color transformations.

Image Compression: Fundamentals, image compression models, error free compression, lossy compression, jpeg, mpeg, h.261, and h.263.

Morphological Image Processing: Preliminaries, dilations and erosion, opening and closing, some basic morphological algorithms.
Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding, and region-oriented segmentation.
Representation, Description and Recognition: Representation-chain codes, polygonal approximation and skeletons, boundary descriptors-simple descriptors, shape numbers, regional descriptors- simple, topological descriptors, pattern and pattern classes-recognition based on matching techniques.

Reference Book(s):

1. Digital Image Processing (3rd/2nd Edition) - R. C. Gonzalez and R.E. Woods; Pearson Prentice Hall (2009).
2. Fundamentals of Digital Image Processing, Academic Press-A. K. Jain.
3. Digital Image Processing, Wiley-Interscience-William K. Pratt.

CSE-3216: Digital Image Processing Sessional

1.5 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Introduction: Image acquisition, image sampling and quantization.
Image transforms: First Fourier Transform (FFT), Discrete Cosine Transform (DCT).
Image Enhancement: Image enhancement in the spatial & frequency domain.
Advanced topics: Morphological image processing, image restoration techniques, image compression techniques, image segmentation, color image processing, and image compression.

Reference Book(s):

1. Digital Image Processing (3rd/2nd Edition) - R. C. Gonzalez and R.E. Woods.
2. Digital Image Processing using Matlab, -Rafel C. Gonzalez & Richard E. Woods, Prentice-Hall.
3. William K. Pratt Digital Image Processing, Wiley-Interscience.

CSE-3222: Programming with Assembly Language Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Introduction: Basic of Assembly Language - Compilation, input, output, variables, basic instructions, memory model, data segment, stack segment, code segment, Input Output Instruction.
Flow Control Instruction: Conditional and unconditional jump instructions, If-then-else, case, for loop, while loop, repeat loop.
Logic, Shift and Rotate Instructions: AND, OR, XOR, complement, shift left, shift right, rotate left, rotate right, rotate carry left, rotate carry right, Binary, Hexa Input Output; Stack and Procedure - Push, Pushf, Pop, Popf; **Multiplication and Division**: Mul, IMul, Div, IDiv.
Array and Addressing moods:1D Array, DUP operator, addressing mode, register indirect mood.
String Instructions: Moving string, load string, scan string, compare string.
File Operations: File errors, opening and closing a file, reading a file, writing a file.

Reference Book(s):

1. Assembly Language Programming and Organization of the IBM PC--Ytha Yu, Charles Marut.

HUM- 3259: Engineering Economics and Sociology
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Microeconomics: Definition of economics; Fundamentals of economics; Market and government in a modern economy; Basic elements of supply and demand; Choice and utility; in difference curve technique; Analysis of cost; Short run long run theory of production.

Macroeconomics: Key concept of macroeconomics; saving, consumption, investment; National income analysis; Inflation, Unemployment. Development: Theories of developments; Banking system of Bangladesh, National Budget, Development partners (World Bank, Asian Development Bank, World Trade Organization, International Monetary Fund).

Sociology: Nature, scope and perspectives of sociology; stages of social research and research methods; culture and civilization; socialization and personality development;

globalization; media and individual; social organization and social problem; social stratification; industrial revolution, capitalism and socialism; work and economic life; environment and human activities; climate change and global risk; population and human society; urbanization and city development; social change and technology.

Reference Book(s):

1. Economic (19thed) – Samuelson (2009).
2. Economic (9thed) – John Sloman (2012).
3. Economic Development (12thed) – Michael Todaro (2015).
4. Money and Banking (2nded) – Dudly g luckett(1976).
5. "Sociology" – ., 2002), Richard T. Schaefer and Robert P. Lamm, MacGraw-Hill, N.
6. "Social Problems" - LeRoy W. Barnes, The Dushkin Publishing Group, Guilford, CT, 2000.
7. "Sociology – Primary Principles" - CN Shankar Rao.

HUM-3261: Financial and Managerial Accounting
2 hours in a week, 2.00 Cr.

Pre-requisite: None

Course Content:

Financial Accounting:

Introduction: Objectives and importance of accounting; Accounting as an information system. Computerized system applications in accounting; Accounting concepts (principles) and conventions; Accounting equation.

Recording system: double entry mechanism; account and their classification;

Accounting cycle: Journal, ledger, trial balance.

Preparation of financial statements: considering adjusting and closing entries.

Financial statement analysis and interpretation: Ratio analysis.

Cost and Management Accounting:

Cost concepts and classification: Overhead cost: meaning and classification;

Distribution of overhead cost: Overhead recover method/rate.

Job order costing: preparation of job cost sheet and question price.

Inventory valuation: absorption costing and marginal/variable costing technique.

Cost- Volume-Profit analysis: meaning, break-even analysis, contribution margin analysis sensitivity analysis.

Short-term investment decisions: Relevant and differential cost analysis.

Long-term investment decisions: capital budgeting, various techniques of evaluation of investments.

Reference Book(s):

1. Managerial Accounting (14th Edition) - Ray Garrison, Eric Noreen and Peter Brewer; McGraw Hill (2011)
2. Accounting Principles (12th Edition) - Jerry J. Weygandt Paul D. Kimmel Donald E. Kieso; Wiley (2015)

CSE-3224: Industrial Training
4 weeks, 1.00 Cr.

Pre-requisite: None

*Note: CSE-3224 (Industrial Training) will be conducted at any convenient time after the 3rd Year, 2nd Semester for a duration of 04 weeks as applicable or decided by the department. Evaluation report from industry is to be submitted at the end of the training and accordingly to be incorporated in the tabulation sheet.

4th Year 1st Semester
CSE-4000: Project / Thesis
6 hours in a week, 3.00 Cr.

Pre-requisite: None
Rationale:
Each student has to complete one Project or Thesis in the combined duration of two semesters or 4th Year. In course CSE-4000 (Part-I) , a student has to make a proposal defense at the end of the semester. The defensed project has to be completed in the continuation course CSE-4000(Part-II) in next semester. This course motivates to go neck-deep in research, synthesize it, and make a point or look at something in a different way after going through all of it.

CSE-4100: Integrated Design Project/ Capstone Project
1.5 hours in a week, 0.75 Cr.

Pre-requisite: CSE-3200, CSE-3222

Course Content:
Knowledge Acquisition: Information gathering techniques, Design of an information system; Hardware components, pin configuration, microcontroller, peripherals, Sensors, PPIs, PICs, Use of Arduino, Raspberry Pi.
Implementation: Concept development, prototype enhancement, complete implementation, unit testing and integration testing with verification, feedback and improvement, result analysis and performance evaluation, report writing, paper submission, presentation and final evaluation.

CSE-4101: Microprocessors, Micro-controllers and Embedded System
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-2101

Course Content:

Microprocessors: 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 ow, Embedded systems specifications and modeling; Embedded hardware platforms and peripherals; Interfacing to the external world through sensors and actuators. Microprocessor based designs; Computer bus standards; Design using special purpose controllers. SAP-1, SAP-2, SAP-3; Product design; Product development process.
Reference Book(s):

1. Assembly Language Programming and Organization of the IBM PC--Ytha Yu, Charles Marut.
2. The Intel Microprocessors - Barry B. Brey.
3. Microprocessors and Interfacing - Douglas V. Hall.
4. Microprocessors and Microcomputer-based system design -Mohamed Rafiquzzaman.
5. 8051 Microcontroller-Internals, Instructions, Programming& Interfacing by SubrataGhoshal.
6. Making Embedded Systems: Design Patterns for Great Software by Elecia White.

CSE-4102: Microprocessors, Micro-controllers and Embedded System Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None
Course Content:

Microprocessors and Micro-controllers: Basic Idea of MDA 8086; LED, Seven Segment display, LCD, Keyboard, Motor, Dot matrix Interface with 8086; Basic idea of ATMEGA 16 microcontroller and simulation.
Introduction to Embedded Systems: 8051 Architecture and C51 Assembly Language Programming - Embedded C

Design of Embedded Systems: Mini Project using the hardware kit, Problem definition, requirements and specifications Software planning - Hardware design and software design.

Reference Book(s):

1. The Intel Microprocessors - Barry B. Brey
2. Microprocessors and Interfacing - Douglas V. Hall
3. Making Embedded Systems: Design Patterns for Great Software by Elecia White

CSE-4103: Compiler Design
3 hours in a week, 3.00 Cr.

Pre-requisite: CSE-2103, CSE-2213
Course Content:

Introduction: Basic issues, compiler structure, front end, back end.
Lexical Analysis: Tokens, patterns, and lexemes, input buffering, transition diagrams, lexical-analyzer generator; **Syntax Analysis:** Elimination of left recursion, left factoring, FIRST and FOLLOW, LL(1) grammars, non-recursive predictive parsing, parser generators.
Syntax-directed Translation: Syntax directed definitions, inherited and synthesized attributes, dependency graphs, syntax-directed translation schemes.
Semantic Analysis: Type expressions, type equivalence, type-checking; Run-time environments: Storage organization, static versus dynamic storage allocation, activation trees, activation records.
Intermediate Code Generation: Directed acyclic graphs for expressions, three-address code, quadruples, triples, static single-assignment form; Code generation; Code optimization: Basic blocks and flow graphs, next-use information, optimization of basic blocks.

Reference Book(s):

1. Compilers: Principles, Techniques & Tools (2nd ed)- Alfred V Aho, Monica S Lam, Ravi Sethi, and Jeffrey D Ullman, Pearson/Addison Wesley (2006).
2. Engineering A Compiler (2nd Ed) - Linda Torczon and Keith Cooper, Morgan Kaufmann Publishers Inc (2011).

CSE-4104: Compiler Design Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None
Course Content:
Laboratory works based on CSE-4103 and project works using some lexical analyzer and parser designing tools.

Reference Book(s):

1. Compilers: Principles, Techniques & Tools (2nd ed)- Alfred V Aho, Monica S Lam, Ravi Sethi, and Jeffrey D Ullman, Pearson/Addison Wesley(2006).
2. Engineering A Compiler (2nd Ed)- Linda Torczon and Keith Cooper, Morgan Kaufmann Publishers Inc(2011).

CSE-4106: Technical Writing and Presentation Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None
Course Content:

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

Reference Book (s):

1. Latex Wikibook.
2. The Elements of Style by E. B. White and William Strunk Jr.

MATH-4107: Applied Statistics and Queuing Theory
3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Statistics: Introduction, frequency distribution, mean, median, mode and other measure of central tendency standard deviation and other measure of dispersion, moments, skewness, kurtosis, elementary probability theory, elementary sampling theory, estimation, hypothesis testing, correlation and regression analysis.
Probability: Probability models, sample space, events, algebra of events, probability axioms, conditional probability, multiplication rule, total probability, Bayes rule.

Random Variables: Discrete, continuous and mixed random variables, probability mass, distribution and cumulative distribution functions.
Probability Distributions: Discrete probability distributions -binomial, Poisson, negative binominal distributions and their properties continuous probability distributions-uniform, normal, exponential distributions and their properties, stochastic process.
Queuing Theory: Stochastic process, discrete time Markov chain and continuous time, Markov chains (birth-death process) queuing models (birth- death model, Monrovian model).
Queuing Model: 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.

Reference Book(s):

1. Introduction to Probability Models-Sheldon M. Ross, 9th Edition.
2. Introduction to Probability-Dimitri P. Bertsekas and John N.Tsitsiklis
3. Probability Theory-Monindra Kumar Roy
4. An Introduction to Statistics and Probability- M. Nurul Islam
5. An Introduction to the Theory of Statistics-R.N.Shil

HUM-4163: Technology Entrepreneurship and Leadership
3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Contents:
Introduction: Technology idea, Introduction to Entrepreneurship, Opportunity identification,
Managing Early-Stage Venture: Pre-launch considerations; The legal protection of Intellectual property, the legal form of an organization, The impact of financing models on business evolution, Assembling human resources, exploring issues -financing a high technology venture,
Marketing: Market research for entrepreneurs (market size, opportunity, segment, competitive advantage, product positioning, pricing), Disruptive versus sustaining innovations, Lead user method, Customer input in innovation strategy formulation.
Business Models: Brand management, Refining of the business model, Sales management; designing and organizing a sales force, Account management, Finance, Expansion of sales team, Guerrilla marketing.
Leadership: Business plan, Growing the organization into a sustainable business; corporate culture, leadership and management.

Reference Book(s):

1. The Innovator's DNA - Jeffrey H. Dyer, Hal Gregersen and Clayton M. Christensen
2. Technology Entrepreneurship - Thomas Duening, Robert Hisrich, Michael Lechter
3. A Seat at the Table: IT Leadership in the Age of Agility - Mark Schwartz

CSE-41XO: Optional-I
3 hours in a week, 3.00 Cr.

CSE-4121: Advanced Algorithms
3 hours in a week, 3.00Cr.

Pre-requisite: None

Course Content:

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.

Reference Book(s):

1. An Introduction to Computational Learning Theory - Michael J. Kearns , Umesh Vazirani; The MIT Press(1994)
2. Algorithm Design (1st Edition) - Jon Kleinberg , Éva Tardos; Pearson(2012)
3. Randomized Algorithms (1st Edition) - Rajeev Motwani , Prabhakar Raghavan; Cambridge University Press(1995)
4. Probability and Computing: Randomized Algorithms and Probabilistic Analysis - Michael Mitzenmacher, Eli Upfal; Cambridge University Press(2005)

CSE-4123: Basic Graph Theory

3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Fundamental Concepts: Groups and their applications, Basic graph terminologies, Basic operations on graphs, Graph representations, Degree sequence and graphic sequence,
Connectivity and Paths: Paths, cycles and connectivity, Network flow, Euler tours, Hamiltonian cycles Ear decomposition.
Trees and Distances: Trees and counting of trees, Distance in graphs and trees.

Advanced Topics: Graceful labeling, Matching and covering, Planar graphs, Digraphs, Graph coloring, Special classes of graphs.

Reference Book(s):

1. Introduction to graph theory - Douglas B West
2. Introduction to Graph Theory - Robin J. Wilson, Pearson Education Asia

CSE-4125: Fault Tolerant System

3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Introduction: Fault Tolerant Systems and architectures; Goal and Application of Fault Tolerant computing, Fundamental Definitions.

System Design and Modeling: Design techniques to achieve fault Tolerance, Reliability Modeling Using Probability Theory, self-checking circuits, burst error correction and triple modular redundancy,

Faults: Fault detection and location in combinational and sequential circuits; faults in memory, memory test pattern and reliability; fault test generation for combinational and sequential circuits, Performance monitoring.

Defects: Defect avoidance, Defect Circumvention, Shield and Hardening, Yields Enhancement, Degradation Allowance.

Reference Book(s):

1. Design and Analysis of Fault Tolerant Digital System (1st Edition) - Barry W. Johnson; Addison Wesley (1989)
2. Dependable Computing: A Multilevel Approach – Behrooz Parhami
3. Fault-Tolerant Systems (1st Edition) - Israel Koren, C. Mani Krishna; Morgan Kauffman (2010)

CSE-4127: Object Oriented Software Engineering

3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Introduction: 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;

Concepts of 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;
Advanced Topics: 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).

Reference Book(s):

1. Object-Oriented Software Engineering – Stephen Schach
2. Object Oriented Software Engineering: A Use Case Driven Approach – Ivar Jacobson
3. Object-Oriented Software Engineering: Practical Software Development using UML and Java – Timothy Lethbridge, Robert Laganiere, Robert Laganiere

CSE-4129: Artificial Neural Networks and Fuzzy Systems
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Brain and neurons, Biological Nervous System, Introduction to artificial neural network and fuzzy systems, Theory and application of Artificial neural networks and fuzzy logic.
Neural Network Concepts: Multi-layer perception, Back propagation algorithm, Self-organization map, Radial basis network, Hop field network, and Recurrent network,
Fuzzy Systems: 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. Kohonen feature. 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.

Reference Book(s):

1. Neural Networks and Fuzzy Systems – Shigeo Abe
2. Introduction to Artificial Neural Systems – Jacek M. Zurada
3. Artificial neural systems: foundations, paradigms, applications, and implementations - Patrick K. Simpson

CSE-4131: Computer Vision
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Introduction to Computer Vision, Case Study-Face Recognition, Linear Algebra/Probability Review.
Image Structure: Linear Filters, Finding Lines-From Detection to Model Fitting, Clustering and Segmentation.
Camera Models: Camera Models, Camera Calibration, Epipolar Geometry, Stereo & Multi-view Reconstruction.
Recognition (Building blocks): Detectors and Descriptors, SIFT & Single Object Recognition, **Optical Flow & Tracking. Recognition (Objects, Scenes, and Activities):** Introduction to Object Recognition and Bag-of-Words Models, Object Classification and Detection- A Part-based Generative Model (Constellation Model),
Object Classification and Detection: A Part-Based Discriminative Model (Latent SVM), Human Motion Recognition. Computer Vision: State-of-the-art and the Future.

Reference Book(s):

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Richard Szeliksy "Computer Vision: Algorithms and Applications" (http://szeliski.org/Book/)
3. Haralick & Shapiro, "Computer and Robot Vision", Vol II
4. G_erard Medioni and Sing Bing Kang "Emerging topics in computer vision"

CSE-4133: Bioinformatics

3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Molecular biology basics: DNA, RNA, genes, and proteins; Genome Rearrangements. Sequence similarity, homology, and alignment.

Pair-wise alignment: Scoring model, dynamic programming algorithms, heuristic alignment, and pair-wise alignment using Hidden Markov Models.
Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA;
Multiple alignment: Scoring model, local alignment gapped and un-gapped 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.

Reference Book(s):

1. An Introduction to Bioinformatics Algorithm (1st Edition)- Neil C. Jones, Pavel A. Pevzner; The MIT Press (2004)

CSE-4135: Robotics
3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Introduction: Introduction to robotics, overview of robot mechanisms, dynamics, and intelligent controls, planar and spatial kinematics, and motion planning;
System Design: Mechanism design for manipulator sand 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.
Advanced Topics: Rigid body velocity, Jacobean, inverse kinematics, redundant and parallel robots, trajectory control, face control and haptics, Micro and Nano-robotics, mobile robots. Human-robot interaction, Multiagent, fault diagnosis.
Reference Book(s):
1. Introduction to Robotics: Analysis, Control, Applications (2nd Edition) - Saeed B. Niku; Wiley(2010)
2. Introduction to Robotics: Mechanics and Control (3rd Edition) - John J. Craig; Pearson (2004)

CSE-4137: Machine Learning
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Introduction to Machine Learning, Supervised and Unsupervised learning;

Regression analysis: Linear Regression and Logistic Regression,
Machine Learning Models: Bayesian Learning, Decision Tree Learning, Rule based learning; Instance based learning; Support Vector Machine; Genetic Algorithms; Reinforcement learning; Hidden Markov Models; Neural Nets; Ensemble learning;
Algorithmic Analysis: Maximum Likelihood Estimates, Parameter Estimation; Computational learning theory.

Reference Book(s):

1. Pattern Recognition and Machine Learning - Christopher M. Bishop; Springer
2. Machine Learning - Tom Mitchell, McGraw Hill
3. Pattern Recognition –Sergios Theodoridis and Konstantinos Koutroumbas; Elsevier Inc.

CSE-4139: VLSI Design
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

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 layout design rules.
CMOS Building Blocks: Adder, Comparator, Multiplier, Counter, and Shifter; Data Path and Memory structures. Design Methodology and Tools; PLA, FPGA, cell-based and full custom design methods, System-on chip design,
Hardware modeling: Hardware Modeling Languages, Logic Networks, State Diagrams, Data-flow and Sequencing Graphs, Behavioral Optimization; Floor Planning and Architecture Design.

Reference Book(s):

1. Modern VLSI Design: System-on-Chip Design (3rd Edition) - Wayne Wolf; Prentice Hall(2002)
2. CMOS VLSI Design- A Circuit and System Perspective (3rd Edition) - Neil H.E. Weste, David Harris and Ayan Banerjee; Pearson (2009)

4th Year 2nd Semester

CSE-4000: Project/Thesis

6 hours in a week, 3.00 Cr.

Pre-requisite: None

Rationale:

This course is a continuation of the course CSE-4000 (Part-I) from the previous semester. A student has to complete the Defensed research proposal, submit it by the end of the semester and make an oral defense of the project/thesis. This course motivates to go neck-deep in research, synthesize it, and make a point or look at something in a different way after going through all of it.

CSE-4201: Artificial Intelligence

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Overview of AI, Knowledge representation, LISP/Prolog and other Al programming languages; Review of Uninformed Search Strategies and game playing;
Informed search Strategies: A*, Heuristic functions, Memory Bounded Search (IDA*, SMA*); Iterative improvement Search, constraint satisfaction problems. Review of Propositional logic, first order Logic, Introduction to Planning, Partial Order Planning.
Learning Algorithms: Bayesian Rule and its use in probabilistic reasoning; Belief Networks and Decision Networks; Learning Decision Trees.
Learning General Logical descriptions: Hypothesis. Introduction to Natural Language Processing.

Reference Book(s):

1. Artificial Intelligence: A Modern Approach (3rd Edition) – Stuart Jonathan Russell, Peter Norvig; Prentice Hall (2010)
2. Artificial Intelligence: A New synthesis – Nils J. Nilsson; Routledge
3. Introduction to Turbo Prolog – Carl Townsend

CSE-4202: Artificial Intelligence Sessional

1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Contents:

Introduction: Introduction to Intelligent Machines, State Mapping.
Searching Algorithms: A* Search implementation, Local search Algorithm, Adversarial Search,

Case Study: Constraint Satisfaction Problem Solving.

Reference Book(s):

1. Artificial Intelligence: A Modern Approach (3rd Edition) – Stuart Jonathan Russell, Peter Norvig; Prentice Hall (2010)
2. Artificial Intelligence: A New synthesis – Nils J. Nilsson; Routledge
3. Introduction to Turbo Prolog – Carl Townsend

CSE-4203: Data and Network Security
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Contents:

Introduction: Overview, Symmetric cipher, Classical encryption technique, Block cipher
Encryption Techniques: 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: 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.

Reference Book(s):

1. Cryptography and Network Security –William Stallings;
2. Cryptography and Network Security- Behrouz A. Forouzan

CSE-4205: Computer Graphics

3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:
Introduction: History, Application of Computer Graphics (Computer Aided Design Animation), a Survey of Graphics I/O Devices and Types. Graphics Software Design: Survey of Desired Function, Toward a Universal Graphic Language. Display Files, Databases for Pictorial Applications. Graphics Techniques: Point-Plotting Techniques, Line Drawing, Geometric Transformations, Windowing and Clipping, Raster Graphics.

Hardware for Computer Graphics: Typical Small and Large System, Graphic Terminals, Plotters, Graphic Display Processors, Device Independent Graphics Systems.
Graphics Software: A Simple Graphic Package, Segmented Display Files, Geometric Models, Picture Structure. Interactive Graphics: Input Techniques, Event Handling, Three-Dimensional Graphics, Curves and Surfaces, 3-D Transformation. Hidden Surface Problem: Back Face Removal, Hidden-Line Removal Curved Surfaces, Describing Points, Lines and Polygons, Some Hints for Building Polygonal Models, Color Perception, RGBA and Color Index Mode, Dithering, Blending, 3-D Blending with the Depth Buffer, Antialiasing, Fog, Fog Equations, the OpenGL ARB**.**
API Specifies: Data Types, Function Naming Conventions, Platform Independence, Drawing Shapes with OpenGL, Animation with OpenGL and GLUT.
Drawing in Space: Lines, Points and Polygons. Co-ordinate Transformations: Understanding Transformations, Matrix Munching Projections, Matrix Manipulation Color Lighting and Materials, Texture Mapping.

Reference Book(s):

1. Introduction to Computer Graphics, Author: Foley J D and others
2. Computer Graphics, Author: Angel E.
3. Computer Graphics, Author: Hearn D and Baker M P
4. Multimedia systems, Author: Stimetz
5. Multimedia: Computing, Communications & Applications, Author: Ralf Steinmetz and Klara Nahrstedt
6. Multimedia Systems Design, Author: Prabhat K. Andleigh and KiranT hakrar.
7. The Complete Animation Course: The Principles, Practice and Techniques of Successful Animation by Chris Patmore.

CSE-4206: Computer Graphics Sessional

3.00 hours in week, 1.5 Cr.

Pre-requisite: None
Course Content:

Drawing: Introduction to OpenGL, drawing 2D geometric object, drawing 3D geometric object
Transformation: Simple 2D and 2D animation and modeling transformation.
Advanced Topics: Viewing transformation and Texturing and lighting.

Reference Book(s):

1. OpenGL Programming Guide: The Official Guide to Learning OpenGL (8th Edition)- Dave Shreiner, Graham Sellers, John Kessenich and Bill Licea-Kane; Addison Wesley Professional (2013).
2. The Complete Animation Course: The Principles, Practice and Techniques of Successful Animation by Chris Patmore.

CSE-4207: Digital Signal Processing

3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

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. Two-dimensional filter design, Quantization effects in digital filters.

Reference Book(s):

1. Digital Signal Processing - John G. Proakis & Dimitris Manolakis
2. Discrete-Time Signal processing - Allan Oppenheim & Ronald Schafer
3. Digital Signal Processing-A practical approach - Emmanuel C. Ifeachor Barrie W.Jervis
4. Signals and Systems - Rodger Ziemer & William Tranter

CSE-4208: Digital Signal Processing Sessional

1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Basic Algorithms: Speech, image & data processing algorithms;

Sampling continuous time signals: Z-transform, Inverse Z-transform, Frequency domain representation, Fourier series and Fourier Transform; Equivalent noise definition of bandwidth; Convolution, Correlation and method of numerical integration;

Computation of the DFT: Goertzel FFT, Chirp Z-transform algorithms, Two-dimensional filter design.

Reference Book(s):

1. Digital Signal Processing - John G. Proakis & Dimitris Manolakis
2. Discrete-Time Signal processing - Allan Oppenheim & Ronald Schafer
3. Digital Signal Processing-A practical approach - Emmanuel C. Ifeachor Barrie W.Jervis
4. Signals and Systems - Rodger Ziemer & William Tranter

CSE-42XO: Option-II
3 hours in a week, 3.00 Cr.

CSE-42XE: Option-II Sessional
3.00 hours in a week, 1.50 Cr.

CSE-4241: Human Computer Interaction

3.00 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

Introduction: Introduction to Human-Computer Interaction.

Task-centered system design: User-centered design and prototyping: methods for involving the user, prototyping, low and medium fidelity. Prototypes, Wizard of Oz examples.

Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method.

Psychology of everyday things: psychopathology of everyday things, examples, concepts for designing everyday things.

Beyond screen design: characteristics of good representations, information visualization, Tufte's guidelines, visual variables, metaphors, direct manipulation.

Graphical screen design: graphical design concepts, components of visible language, graphical design by grids. **Design principles and usability heuristics**: design principles, principles to support usability, golden rules and heuristics, HCI patterns. SemIoTic in HCI**.**

HCI design standards: process-oriented standards, product-oriented standards, strengths and limitations of HCI Standards.

Pastand future of HCI: the past, present and future, perceptual interfaces, context-awareness and perception.

Reference Book(s):

1. Human-Computer Interaction (3rd Edition) – Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale; Prentice Hall (2003)
2. Interaction Design: Beyond Human Computer Interaction (5th Edition) - Yvonne Rogers, Helen Sharp, Jenny Preece; John Wiley & Sons (2019)
3. Designing the User Interface (5th Edition) - Schneiderman, B. and Plaisant, C.; Addison-Wesley (1998)

CSE-4242: Human Computer Interaction Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None
Course Content:

Introduction: Introduction to Human-Computer Interaction.
Design: Task-centered system design and graphical design by grids,
Advanced Topics: Design principles, design concepts, Prototype, IDM, SemIoTic in HCI.

Reference Book(s):

1. Human-Computer Interaction (3rd Edition) – Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale; Prentice Hall (2003)

CSE-4243: Pattern Recognition
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Introduction to pattern recognition, Statistical and Neural Pattern Recognition, Bayesian decision theory.
Classifiers: Linear classifiers, nonlinear classifiers,
Estimation Techniques: parametric estimation techniques, Non-parametric estimation techniques;
Advanced Topics: Template matching, Dynamic programming methods, Correlation methods, Hidden Markov model, Support vector machine, Syntactic pattern recognition, Clustering algorithms, and Principle component analysis.

Reference Book(s):

1. Pattern Classification (2nd Edition) - R. O. Duda, P.E.D. Hart and G. Stork; John Wiley and Sons (2000)
2. Pattern recognition (4th Edition) –Sergios Theodoridis and Konstantinos Koutroumbas; Academic Press (2008)

CSE-4244: Pattern Recognition Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None
Course Content:

Classic Classifiers: Bayes Classifier, Perceptron Algorithm, Pocket Algorithm, Edit Distance, Basic Sequential Algorithmic Scheme, Support Vector Machine, Decision Tree.

Clustering: K-Means Clustering algorithm.
Modern classifiers: Neural Network.

Reference Book(s):

1. A Guide to MATLAB for Beginners and Experienced Users (2nd Edition) - Brian R. Hunt Ronald L. Lipsman Jonathan M. Rosenberg with Kevin R. Coombes, John E. Osborn, and Garrett J. Stuck; Cambridge University Press (2006)
2. Sergios Theodoridis Introduction to Pattern Recognition: A Matlab Approach (1st Edition)-Sergios Theodoridis, Aggelos Pikrakis, Konstantinos Koutroumbas and Dionisis Covourous; Academic Press (2010).

CSE-4245: Mobile and Ubiquitous Computing
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Introduction: Evolution of mobile computing systems, Affordances of mobile systems (ubiquitous connectivity, personalization, context awareness).
Constraints of the mobile platform: wireless quality, battery limitations, UI limitations, sensing accuracy. **Protocols:** Network and Transport Protocol for Wireless Networks, Mobile IP and Variants of TCP;
Mobile Computing: Distributed Systems platforms for Mobile Computing, Proxy Based Architectures, Service Discovery, Interaction Platforms; File System support for Mobile Computing;
Ubiquitous computing: Development in Context-aware and Ubiquitous computing; Smart Embedded devices, Information Appliance and Wearable computers; Sensing and Context Acquisition in Ubiquitous Computing; Proximity-based Networking, Communication protocol for Wireless Sensor Networks; Human Interaction in Ubiquitous Computing Environments, Tangible User Interfaces, Privacy and Security. Technological Component of Location Based Service (LBS)- WAP, GPS, Cell Based Location, 3G wireless, VXML, SMS-MMS, Personal Area Networks (802.11, Bluetooth, IRFIDs), Micro-Electro- Mechanical (MEMES), Recommender systems (Collaborative Filtering, Intelligent Agents). Android Framework, and Application structure.

Reference Book(s):

1. Context-Aware Mobile and Ubiquitous Computing for Enhanced Usability: Adaptive Technologies and Applications (1st Edition) –Dragan Stojanovic; Information Science Reference (2009)
2. Fundamentals of Mobile and Pervasive Computing (1st Edition) - Frank Adelstein, Sandeep KS Gupta, Golden Richard III and Loren Schwiebert; McGraw-Hill (2004)
3. Handbook on Mobile and Ubiquitous Computing: Status and Perspective (1st Edition) –Laurence T. Yang, EviSYukur and Seng W. Loke; CRC Press (2013)

CSE-4246: Mobile and Ubiquitous Computing Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Mobile Computing: Evolution of mobile computing systems, Affordances of mobile systems.
Protocols: Network and Transport Protocol for Wireless Networks, Mobile IP and Variants of TCP, Proximity based Networking, Communication protocol for Wireless Sensor Networks.

Reference Book(s):

1. Handbook on Mobile and Ubiquitous Computing: Status and Perspective (1st Edition) - Laurence T. Yang, EviSYukur and Seng W. Loke; CRC Press (2013)
2. Android Studio 3.0 Development Essentials (1st Edition) - Android 8 Edition; CreateSpace Independent Publishing Platform (2017

CSE-4247: Simulation and Modeling
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Simulation modeling basics: systems, models and simulation; Classification of simulation model; Steps in a simulation study;
Concepts in discrete-event simulation: event scheduling vs. process interaction approaches, Time-advance mechanism, organization of a discrete-event simulation model; continuous simulation models;

Combined discrete-continuous models; Monte Carlo simulation; Simulation of queuing systems. Building valid and credible simulation models: validation principles and techniques, statistical procedures (or comparing real-world observations and simulation outputs, input modeling;
Random Generation and Analysis: Generating random numbers and random variants; Output analysis. Simulation languages; Analysis and modeling of some practical systems, Random Number Generator, Random Variables, Probability Distribution.

Reference Book(s):

1. Simulation Modeling and Analysis (5th Edition) - Law A. M., Kelton W. D.; McGraw Hill (2014)
2. Computer Aided Modeling and simulation - J. A. Spriet
3. Computer Simulation and Modeling - R. S. Lehman
4. System Simulation - G. Cordon

CSE-4248: Simulation and Modeling Sessional
1.5 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Simulation modeling basics: systems, models and simulation, Classification of simulation model, Steps in a simulation study.
Advanced Topics: Single Server Queuing System, Inventory Management System, Monte Carlo Method, Pure Pursuit Problem, Probability Distribution Fitting, Random Number Generation, Hypothesis Testing.

Reference Book(s):

1. Discrete-Event System Simulation (5th Edition) - Jerry Banks; Prentice Hall (2009)

CSE-4249: Data Mining and Data Ware-housing Sessional
3 hours in a week, 3.00 Cr.

Pre-requisite: None
Course Content:

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

Reference Book(s):

1. Data Mining: Concepts and Techniques - Jiawei Han, Micheline Kamber, and Jian Pei, (Morgan Kaufmann)
2. Data Mining and Data Warehousing - Bharat Bhushan Agarwal, Sumit Prakash Tayal
3. Data Warehousing, Data Mining, and OLAP - Alex Berson and Stephen J. Smith

CSE-4250: Data Mining and Data Ware-housing Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:

Data warehousing: Data warehousing and OLAP technology, Data preprocessing, Data visualization techniques, Data Cube computation and multidimensional data analysis,
Descriptive data mining: Association analysis; Classification and prediction; Cluster analysis; Mining complex types of data.

Reference Book(s):

1. Data Mining: Concepts and Techniques - Jiawei Han, Micheline Kamber, and Jian Pei, (Morgan Kaufmann)
2. Data Mining and Data Warehousing - Bharat Bhushan Agarwal, Sumit Prakash Tayal
3. Data Warehousing, Data Mining, and OLAP - Alex Berson and Stephen J. Smith

CSE-4251: Advanced Database Management Systems
3 hours in a week, 3.00 Cr.

Pre-requisite: None

Course Content:

Object oriented database: data model, design, languages;
Object relational database: complex data types, querying with complex data types, design; distributed database: levels of distribution transparency, translation of global queries to fragment queries, optimization of access strategies, management of distributed transactions, concurrency control, reliability, administration;

Parallel Database: different types of parallelism, design of parallel database; multimedia database systems basic concepts, design, optimization of access strategies, management of multimedia database systems, reliability;
Database warehousing/ data mining: basic concepts and algorithm.

Reference Book(s):

1. Database Systems: The Complete Book (2nd Edition) - Hector Garcia-Molina, Jeffrey D. Ullman and Jennifer Widom; Pearson (2008)
2. Concurrency control and Recovery in Database Systems (1st Edition) - P. a Bernsteinand
3. N. Goodman; Addison-Weasley (1987)

CSE-4252: Advanced Database Management Systems Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Content:
Database Types: Object oriented database, Distributed database,
Database Management: Management of distributed transactions, concurrency control, reliability, administration, Management of multimedia database systems, reliability;
Database ware-housing/data mining: basic concepts and algorithms.

Reference Book(s):

1. JAVA How to Program (9th Edition) – Paul Deitel, Harvey Deitel; Prentice Hall(2011)
2. Microsoft C# Professional Projects (1st Edition) – Geetanjali Arora, B. Aiaswamy, Nitin Pandey; Course Technology PTR (2002)
3. PHP: The Complete Reference (1st Edition) - Steven Holzner; McGraw Hill Education (2007)

CSE-4253: Internet of Things (IoT)
3.00 hours in a week, 3 Cr.

Pre-requisite: None
Course Contents:

Introduction to Internet of Things: Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies.
IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, Embedded Systems, IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5.
Domain Specific IoTs I: Home Automation, Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities- Smart Parking, Smart Lighting, Structural Health

Monitoring, Surveillance, Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection.

Domain Specific IoTs II: Energy-Smart Grids, Renewable Energy Systems, Prognostics, Retail- Inventory Management, Smart Payments, Smart Vending Machines, Logistics- Route Generation &Scheduling, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture-Smart Irrigation, Green House Control, Industry-Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring, Health & Lifestyle, Wearable Electronics.

IoT and M2M: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization, IoT System Management with NETCONF-YANG, Need for IoT Systems Management, Network Operator Requirements, NETCONF, YANG.

IoT Platforms Design Methodology: Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration, Case Study on IoT System for Weather Monitoring, IoT Physical Devices & Endpoints, Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, pc Duino, Beagle Bone Black, Cubieboard.

IoT Physical Servers & Cloud Offerings: Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Django Architecture, Starting Development with Django, Amazon Web Services for IoT, Amazon EC2, Amazon Auto Scaling, Amazon S3, Amazon RDS, Amazon Dynamo DB, Amazon Kinesis, Amazon SQS, Amazon EMR, Sky Net IoT Messaging Platform.

Reference Book(s):

1. Internet of Things: A Hands-On Approach - Vijay Madisetti and Arshdeep Bahga, VPTedition1, 2014.
2. Designing for Emerging- UX for Genomics, Robotics, and the Internet of Things Technologies - Jonathan Follett, O'Reilly, 2014

CSE-4254: Internet of Things (IoT) Sessional
1.50 hours in a week, 0.75 Cr.

Pre-requisite: None

Course Contents:

Students will perform experiments to practically verify the theories and concept have learned in the theory course CSE 4253 using simulation software or hardware kit.

Reference Book(s):

1. Internet of Things: A Hands-On Approach - Vijay Madisetti and Arshdeep Bahga, VPTedition1, 2014.
2. Designing for Emerging- UX for Genomics, Robotics, and the Internet of Things Technologies - Jonathan Follett, O'Reilly, 2014.

Chapter 5
Courses Offered to Other Departments

5.1 Courses Offered to the Department of EEE

Sl.	Course No	Course Title	Hours/Week		Credits	Year/ Semester
			Theory	Sessional		
1.	CSE-1209	Computer Programming	3.00	-	3.00	Y1/S2
2.	CSE-1210	Computer Programming Sessional	-	3.00	1.5	Y1/S2

5.2 Courses Offered to the Department of English Language and Literature

Sl.	Course No	Course Title	Hours/Week		Credits	Year/ Semester
			Theory	Sessional		
1.	CSE-1161	Computer and Information Technology	3.00	-	3.00	Y1/S1

5.3 Courses Offered to the Department of Law and Justice

Sl.	Course No	Course Title	Hours/Week		Credits	Year/ Semester
			Theory	Sessional		
1.	CSE-1202	Computer and Information Technology	3.00	-	3.00	Y1/S1