Program Handbook

Bachelor of Science in Computer Science and Engineering

(Session 2021-2022 and onwards)

SCHOOL OF SCIENCE AND TECHNOLOGY
BANGLADESH OPEN UNIVERSITY
Gazipur-1705, Bangladesh

Phone: 88-02-9291111
Website: www.bou.ac.bd, www.bousst.edu.bd
Facebook Page: www.facebook.com/SSTBOU

Dean's Message

Dear Learners,

I welcome you to the B.Sc. in Computer Science Program through distance mode. The program is structured as per latest development in Computer Science and Applications and also need of the Information Technology Industry requirements. In integrated mode, you will receive support from Bangladesh Open University (BOU) through Internet as well as through the network of our Regional Center and Dept. of CSE, DUET, Gazipur as Study Center, where you will be offered counselling and tutorial class (both Theory and Practical). We are going to offer a program handbook covering a brief introduction to BOU, its background and programs, study centre and tutorial services, academic and examination ordinance, course curriculum and syllabus and other information. You are advised to read carefully the handbook for future needs. The academic calendar and assignments are distributed to the learner from the Study Center. The B.Sc (Hons.) program in Computer Science and Engineering has been designed to improve the competitiveness of graduates with a strong theoretical background and professional skills. For this reason, the program is comprised of a suitable mix of both the distance and conventional mode of delivery. The faculty members of the Dept. of CSE, Dhaka University of Engineering and Technology and faculty members of BOU will be engaged in providing quality teaching.

As a distance learner, you may have several queries, many of which would be answered in the program handbook. Anyway, we hope that you will preserve this program handbook until you complete the program.

You are advised to visit BOU websites: www.bou.edu.bd or www.bousst.edu.bd. The learners, pursuing the degree of B.Sc in Computer Science and Engineering will find this learner guide as an indispensable reference for their entire 4-year undergraduate academic program. The program handbook may also be useful for the teachers conducting lectures on the respective courses. I wish you success in pursuing the program.

Wish you all the best.

Professor DR. Sharker Md. Numan
Dean

Contents

BOU at a glance

Establishment	October 21, 1992
Type	Public University
Chancellor	Md. Abdul Hamid
	Honorable President of the People's Republic of Bangladesh
Vice-Chancellor	Prof. Dr. Syed Humayun Akhter
Pro-vice Chancellor	Prof. Dr. Nasim Banu and
	Prof. Dr. Mahbuba Nasreen
Treasurer	Prof. Mostafa Azad Kamal
Area	35 acres
Location	Board Bazar, Gazipur
No. of Schools (Faculties)	6
No. of Division	11
No. of Teachers	139
No. of Students	5,19,615 (2020);
	4,14,626 (Session 2020-2021) (as on December)
No. of Officers	536
No. of Employees	690
No. of Formal Programs	60
No. of Non-formal Programs	19
No. of Regional Centers	12
No. of Sub-Regional Centers	80
No. of Study Centers	1551

Academic Programs of BOU

School of Education (SoE)
- Bachelor of Education (BEd)
- Master of Education (MEd)
- M.Phil. and PhD in Education

School of Social Science, Humanities and Language (SSHL)
- BA and BSS (3-year program)
- MA and MSS (1 and 2-year programs)
- 4-year Bachelor (Hons) programs: Bangla, History, Philosophy, Islamic Studies, Political Science, Sociology and Law

Open School (OS)
- Secondary School Certificate (SSC)
- Higher Secondary Certificate (HSC)
- Master of Business Administration (MBA)
- Master of Digester Management(MDM)

School of Business (SoB)
- Bachelor of Business Administration (BBA)
- Master of Business Administration (MBA)
- Commonwealth Executive Master of Business Administration (CEMBA)
- Commonwealth Executive Master of Public Administration (CEMPA)
- M.Phil. and Ph.D.

School of Agriculture and Rural Development (SARD)
- Bachelor of Agricultural Education (BAgEd)
- MS in Agriculture Science

School of Science and Technology (SST)

♦ Diploma in Computer Science and Application (DCSA)

♦ B.Sc in Computer Science and Engineering (B.Sc in CSE)

♦ Master of Disability Management and Rehabilitation (MDMR)

♦ Master of Public Health (MPH)

♦ Post-Graduate Diploma in Medical Ultrasound (PGDMU)

♦ B.Sc (Hons) in Food Science and Nutrition

♦ *M.Sc in* Computer Science and Engineering *(Upcoming)*

♦ *M.Sc in Pharmacology, B.Pharm (Hons) and M.Pharm (Upcoming)*

♦ *Diploma in Health Professionals Education (Upcoming)*

♦ *M.Phil. and PhD*

Welcome to the Open Learning system at the Bangladesh Open University. Through a wide variety of distance education programs, Bangladesh Open University extends learning opportunities to people over the country. It allows you to choose your home as your campus and integrate learning into an adaptable, self-determined schedule. We hope that our commitments to distance learning will facilities your pursuit of knowledge relevant to your life and career. BOU degree is nationally and internationally accepted for higher studies and job placement.

Conventional versus Open and Distance Education System

In the conventional education system, you are being educated in an on-campus environment where teachers deliver lectures as per regular class schedule in a face-to- face situation. That is a teacher-centered approach and you enjoy little or no flexibility in the class and examination schedules. You are being controlled closely by the institution. You have to go to the campus every working day and attend classes regularly. You have to be a regular learner and probably have to depend on others to support you. There you can enjoy frequent face-to-face contact with teachers but you have to complete specific courses at a specific time. Whereas System of Open and Distance Education, you do not need to attend class regularly. This off-campus system facilitates your learning at your home/work place by providing you with specially designed learning materials. Audio and video programs will help you to understand the difficult sections of your text. You will also be able to get the facilities of video-conferencing, e-mail, internet and web-based teaching and learning systems. In this multimedia-based education system, you will be able to use your own time and devotion. You can also enjoy the benefits of tutorial services where learners come to solve their problems while studying learning materials and/or while preparing assignments.

Bangladesh Open University

Established on October 21, 1992, with a vision for partial fulfilment of the national commitment to 'education for all', especially for the disadvantaged group of people using every means of communication technology. The main campus of the University is situated at Boardbazar, Gazipur about 18 kilometres north of Dhaka. The prime objective of Bangladesh Open University is to transform the country's vast human resources into an educated and trained work force by extending a wide range of academic programs both formal and non-formal. BOU's programs are aimed at everyone, particularly working people and women moreover those social disadvantage groups who cannot enroll in traditional educational institutions.

In place of campus-based teaching, this university uses technology including electronic devices to reach out to people in different corners of the country. The learner of this university is not restricted by time, space or age. A learner can think and learn at his own will, at his place and at any time whenever he/she feels free to learn. BOU imparts 'education to all' through print and electronic media and also through tutorial sessions in the tutorial centers. The learners of all academic programs of BOU are provided with a set of Self Learning Materials (SLMs) written in modular form. Since its inception, BOU has been offering secondary to tertiary and non-formal education. To bring education to the doorsteps of the people, BOU is continuing its operation through 12 Regional Centers (SC) throughout the country.

Vision

Bangladesh Open University strives to ensure education for all in the country through open and distance learning system and to excel as a caterer of higher education.

Mission

The mission of BOU is to spread quality education, both general and need-specific, among all sections of citizens of the country irrespective of their age and gender in a flexible manner by using a suitable mix of educational media and technologies.

School of Science and Technology

School of Science and Technology is one of the six schools of Bangladesh Open University. The main objective of this school is to provide a platform for teaching, learning and research in the field of science and technology and health science and to create scientific and technically skilled manpower in the country. The extended activities of this school are scientific awareness, degree awarding and advanced research programs. The on-going academic programs of the school are Diploma in Computer Science and Application (DCSA), BSc in Computer Science and Engineering, Master of Disability Management and Rehabilitation (MDMR), Master of Public Health (MPH), Postgraduate Diploma in Ultrasound and BSc.(Hons) in Food and Nutrition. After receiving the degree, learners would become well-placed in society. Energetic, active, motivated and skilled faculties having higher degrees from home and aboard are engaged in teaching both the face-to-face and distance mode. They are also engaged in research projects and designing laboratories in various fields including software development. The school has academic and research collaborations with national and international institutions.

Laboratory of SST

Some sophisticated laboratories have been set in the lab. They are named in Computer programming lab, Computer Networks Lab, Digital and Hardware Lab, Processors Lab, Food and Nutrition Lab, Physical Wellness Lab etc. Students and faculty members utilize their needs with satisfaction.

List of Faculty Members of the School

Professor

Dr. Sharker Md. Numan
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Research Interest: *Public Health, E-Learning, Instructional Design*
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Associate Professor

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Assistant Professor

Saria Islam
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Lecturer

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Faculty members of the school

Academic Activity of the School

The ongoing academic programs of the school are Diploma in Computer Science and Application (DCSA), B.Sc in Computer Science and Engineering, Master of Disability Management and Rehabilitation (MDMR), Master of Public Health (MPH), Postgraduate Diploma in Ultrasound and BSc.(Hons) in Food and Nutrition. and Bachelor of Science in Nursing. The DCSA program was launched in 1998. It consists of 35 credits and duration of the program is one and half year. After completion of the program, diploma holders are well-placed in society. In 2013 school launched a 4-year B.Sc. in computer science and Engineering. Students are well-established in the IT sector including higher studies. Other popular programs are Master of Disability Management and Rehabilitation (MDMR) and Master of Public Health (MPH). These are 72

credits and 60 credits programs and have been launched in 1997 and 2018 respectively. The school arranges seminars, promotional activities of the programs, and coordination meetings with the coordinators, tutors of the study centers, and other resource persons. Study tours and picnics are arranged to renowned places of the country regularly.

Scientific Seminar at Dhaka campus

Journal and Publication

In recent year, a handsome amount of research papers by the faculty members have been published in several renowned national and international journals and conference proceedings. Research works are motivated by academic interest as well as the socio-economic problems at the national level. Once a year, school publishes a research journal named "Journal of Scientific and Technological Research (JSTR)". Books in the modular form, program handbook/brochure, study guide and other study materials are published by the school as well.

Basic Information and Regulation of the Program

Name of the program
Bachelor of Science in Computer Science and Engineering, in short 'B. Sc in CSE'.

Title of the Degree
Bachelor of Science in Computer Science and Engineering

Code of the Program
The program code of the B.Sc in CSE program shall be 52.

Aims and Objectives of the Program
The B.Sc in Computer Science and Engineering (CSE) program is designed to produce skilled graduates to satisfy the growing demands of computer engineers at home and abroad. It provides the learners with an opportunity to obtain a broad knowledge of Computer Science and Engineering with some freedom to tailor the program according to the learner's individual needs. The objectives of the program are-

❖ to produce engineers equipped with technical knowledge and skills, with the ability to apply them correctly, and with creativity and self-development.
❖ to train them the communication and collaboration skills and the ability to use new technologies to develop themselves to move with the rapidly innovative world.
❖ to produce scientists and engineers equipped with morals and ethics.
❖ to create opportunities for teaching and research in Computer Science and Engineering.

Prospect/Employments Opportunity
After completion of B.Sc in Computer Science and Engineering program, a learner should be able to get a job in the field of information and Communication Technology (ICT). Graduates with their degree of B.Sc in Computer Science and Engineering will be well placed in the following key areas-

❖ production and development industry;
❖ software development company;
❖ measurements, instrumentation and testing computing;
❖ information and communication technology sector; and
❖ teaching and research;

Besides this, an in-service graduate will get up graduation/promotion.

Eligible Criteria for Admission
To be eligible for admission, a candidate must be passed HSC/equivalent examination in the current year or years before the notification. For applying and taking part in the admission test for admission into the B. Sc in Computer

Science and Engineering program, a candidate must fulfill the following requirements.

(i) Candidates must have passed SSC and HSC examinations or its equivalent examinations in Science group with a minimum GPA of 3.0/2nd division in SSC/equivalent and 3.0/2nd division in HSC/equivalent examinations. In addition, Applicants must have in Mathematics /Higher Mathematics and in Physics with a minimum GPA of 2.5/2nd division in HSC examination separately.

Or,

(ii) Applicants who obtained a 4(four) years Diploma from the Technical Education Board in Mathematics /Higher Mathematics and Physics with a minimum GPA of 2.5(scale-4)/2nd division are eligible to apply. In addition, Applicants must have a Mathematics /Higher Mathematics and in Physics with a minimum GPA of 2.5(scale-4)/2nd division in HSC examination separately.

Or,

(iii) Applicants who passed the 'Diploma in Computer Science and Application (DCSA)' from Bangladesh Open University are eligible to apply for the admission test. But candidates from Science group in HSC/equivalent examination will be given priority.

Application Procedure

Application shall be submitted online after advertising of admission of the program in the National Dailies, Radio and TV. Application processing fee shall also be sent online using a mobile banking service during submission of application. All the instructions and guidelines regarding submission of application, collection of admit card and application fee payment procedure would be mentioned clearly both in the advertisement and the web site. A hard copy (printed copy) of application with the following necessary documents shall be submitted during the viva-voce.

❖ Online application form with original certificates, mark sheets/transcripts of SSC & HSC examinations;
❖ Admit card;
❖ Small ethnic groups/ Freedom fighters/Dependents of freedom fighters/employee of BOU/Diploma holders from BOU must produce an original certificate of proof and attested copy of it;
❖ 3 copies of duly attested passport-size photograph;
❖ Birth certificate.

Selection Procedure

Selection of learners shall be given based on competitive written tests and viva voce.

(i) **Written Admission Test:** Admission test will be conducted based on the current syllabi of Mathematics, Physics, Bangla and English of the HSC examination. The written test consists of MCQ and/or descriptive questions/problem solving and the total mark is 80. Duration of the written test shall be an hour. Subject-wise distribution of marks is as follows.

Serial	Subject	Marks	Syllabus
1.	Mathematics	35	Current
2.	Physics	35	Syllabi of
3.	Writing Ability test (Bangla and English)	5+5	the HSC Examination
	Total	80	

(ii) **Interview/Viva-voce:** Candidates will be attending an interview/viva-voce based on their results of the written test. 10 marks are allocated for viva voce and 10 marks are allocated for obtaining a score out of 5 from SSC and HSC examinations.. Based on both the marks (written, viva-voce and score from SSC and HSC examinations) learners shall be finally selected and then a merit list shall be published

(iii) Applicants who passed the Diploma in Computer Science and Application (DCSA) program from Bangladesh Open University can apply.

(iv) 10% seats will be reserved for the applicants who have completed Diploma in Computer Science and Application Program from BOU and other quotas shall be maintained as per Govt. rules.

(v) Admission Committee reserves all rights to make any changes.

Number of seats: 130 (may vary as and when BOU decides).

Academic Year and Semester of the Program

The academic year of the program shall start in July of each calendar year and shall end in June of the next year. Each academic year shall be divided into two semesters as follows:

Semester	Duration
1st Semester	January-July
2nd Semester	July-December

Program Plan

A learner shall have to complete 148 credits to receive the degree. Learner should submit a Project report and should appear Comprehensive Viva-voce in the 8th semester.

Duration of the program	: 4 year
Total Semester	: 8
Semester length	: 6 months
Total credit	: 148

Tenure of Registration

The registration of a learner in the B.Sc in CSE program shall remain valid for 8 years (i.e., for consecutive 16 semesters) since her/his admission into the program unless the learner falls under any of the following categories.

❖ cancellation or suspension of registration, or
❖ discontinuation, or
❖ expulsion for adopting unfair means.

Condition for next year and semester registration

(i)   Regular students are allowed to register in the next year and semester by paying the necessary fee(s) as directed in the regulation.

(ii)   Irregular students are allowed to register in the next year and semester with due permission from Dean, SST, BOU and by paying twice the regular semester registration fee.

(iii) Besides it, in both cases above students have to register for a course after attending the classes and appearing in the examination of prerequisite course(s).

Medium of Instruction

Medium of instruction for the B.Sc in CSE must be English unless otherwise directed.

Types of Courses

The courses for this program consist of

❖ Theoretical courses;
❖ Laboratory/ Sessional courses;
❖ Comprehensive viva voce;
❖ Project work.

Number of Courses and Credit Distributions

Total credits of the program are 148 and the credit distributions are given bellow.

	Type	Number of Courses	Credits
A.	General Courses	04	09
B.	Basic Science Courses	06	17
C.	Core Courses (Theory)	30	86
D.	Practical/Laboratory/Sessional courses	24	30
E.	Project Work	1	4
F.	Comprehensive Viva Voce	1	2
Total(Theory+Practical/Laboratory/Sessional courses+Project+Comprehensive Viva Voce)	(4+6+30+24+1+1)=66		148

Course Designation and Numbering System

Each course is designated by a three-letter code identifying the discipline and by four digits. Number/character is as follows:

(i) The first digit will correspond to the year in which the course is normally taken;

(ii) The second digit indicates the semester;

(iii) The third digit indicates the total credit of the course;

(iv) The character 'P' indicates either 1.5 credit or 0.75 credit for each practical/ laboratory/ sessional course;

(v) The fourth digit is reserved for the course number;

Year and Semester Wise Course and Credit Hour Distribution

First Year First Semester

Course Code	Course Title	Credit	Pre – requisite*
ENG1131	Communicative English	3.0	-
PHY1132	Wave, Optics and Thermodynamics	3.0	-
BUS1123	Introduction to Business	2.0	-
MAT1134	Differential and Integral Calculus	3.0	-
EEE1135	Electricity, Magnetism and Electrical Circuit	3.0	-
EEE11P6	Electricity, Magnetism and Electrical Circuit Lab	0.75	-
CSE1127	Computer Fundamentals	2.0	-
CSE11P8	Computer Fundamentals Lab	0.75	-
Total Credit		**17.5**	

First Year Second Semester

Course Code	Course Title	Credit	Pre - requisite*
MAT1231	Linear Algebra and Differential Equations	3.0	-
HUM1222	Bangladesh Studies	2.0	-
EEE1233	Electronic Device and Circuits	3.0	EEE1135
EEE12P4	Electronic Device and Circuits Lab	1.5	EEE11P6
CSE1235	Digital Logic Design	3.0	-
CSE12P6	Digital Logic Design Lab	1.5	-
CSE1237	Structured Programming Language	3.0	-
CSE12P8	Structured Programming Language Lab	1.5	-
Total Credit		**18.5**	

Second Year First Semester

Course Code	Course Title	Credit	Pre - requisite*
MAT2131	Coordinate Geometry and Vector Analysis	3.0	-
CHE2122	Chemistry	2.0	-
CSE2133	Discrete Mathematics	3.0	-
CSE2134	Computer Architecture and Organizations	3.0	
CSE2135	Data Structure	3.0	CSE1237
CSE21P6	Data Structure Lab	1.5	CSE12P8
CSE2137	Object Oriented Programming	3.0	CSE1237
CSE21P8	Object Oriented Programming -I Lab	1.5	CSE12P8
Total Credit		**20**	

Second Year Second Semester

Course Code	Course Title	Credit	Pre - requisite*
ECO2221	Introduction to Economics	2.0	-
CSE2232	Microprocessors and Microcontrollers	3.0	CSE2134
CSE22P3	Microprocessors and Assembly Language Lab	0.75	-
CSE2234	Information System Analysis and Design	3.0	-
CSE22P5	Information System Analysis and Design Lab	0.75	-
CSE2236	Computer Algorithms	3.0	CSE2135
CSE22P7	Computer Algorithms Lab	1.5	CSE21P6
CSE2238	Database Management System	3.0	-
CSE22P9	Database Management System Lab	1.5	-
Total Credit		**18.5**	

Third Year First Semester

Course Code	Course Title	Credit	Pre - requisite*
MAT3131	Statistics and Probability	3.0	-
CSE3122	Theory of Computation	2.0	CSE2133
CSE3133	Data and Telecommunications	3.0	
CSE3134	Operating System	3.0	-
CSE31P5	Operating System Lab	1.5	-
CSE3136	Advanced Database Management System	3.0	CSE2238
CSE31P7	Advanced Database Management System Lab	1.5	CSE22P9
CSE31P8	Object Oriented Programming-II Lab	1.5	CSE2137
CSE31P9	Numerical Analysis Lab	1.5	
Total Credit		**20**	

Third Year Second Semester

Course Code	Course Title	Credit	Pre - requisite*
CSE3221	E-commerce	2.0	-
CSE3232	Human-Computer Interaction	3.0	
CSE3233	Computer Networks	3.0	CSE3133
CSE32P4	Computer Networks Lab	1.5	CSE3133
CSE3235	Computer Peripherals and Interfacing	3.0	CSE2232
CSE32P6	Computer Peripherals and Interfacing Lab	0.75	CSE22P3
CSE3237	Software Engineering	3.0	CSE2137 & CSE2234
CSE32P8	Software Development Project	1.5	CSE21P8
CSE32P9	Technical Writing and Seminar	1.5	-
Total Credit		**19.25**	

Fourth Year First Semester

Course Code	Course Title	Credit	Pre - requisite*
CSE4121	Professional Ethics and Cyber Law	2.0	-
CSE4132	Principles of Distributed Systems	3.0	CSE3233
CSE4133	Artificial Intelligence	3.0	
CSE41P4	Artificial Intelligence Lab	0.75	-
CSE4135	Web Engineering	3.0	-
CSE41P6	Web Engineering Lab	1.5	-
CSE4137	Computer Graphics and Multimedia System	3.0	-
CSE41P8	Computer Graphics and Multimedia System Lab	0.75	
Total Credit		**17**	

Fourth Year Second Semester

Course Code	Course Title	Credit	Pre - requisite*
CSE4231	Cryptography and Network Security	3.0	CSE3233
CSE4232	Compiler Design	3.0	CSE3122
CSE42P3	Compiler Design Lab	0.75	-
CSE4234	Mobile Application Development	3	CSE3237
CSE42P5	Mobile Application Development Lab	1.5	
CSE4246	Project	4.0	-
CSE4227	Comprehensive Viva Voce	2.0	-
Total Credit		**17.25**	

* Learners will be able to register for a course(s) after attending the classes and appearing in the examination of the pre-requisite course(s) (if applicable).

Credit-Wise Learning Hour Distribution

| Credit	Mode of Delivery	
	Class Room Learning/Face-to-Face Session	**Web-Based Lectures, Self-Learning, Assignment, Quiz etc.**
3.0 (Theory)	24 Hours	21 Hours
2.0 (Theory)	16 Hours	14 Hours
1.5 (Laboratory)	36 Hours	6 Hours
0.75 (Laboratory)	18 Hours	3 Hours

TUTORIAL SERVICE

The methodology of instruction of the university is different from that of the conventional universities. The Bangladesh Open University system is more learner-oriented, and the learner has to be an active participant in the teaching-learning process. Bangladesh Open University uses a mix of media considering the access and affordability of the learners. Both synchronous and asynchronous media are used for the effective delivery of the courses. Most of the instruction is imparted through a distance with only a small component of face-to-face communication. The university follows a multi-channel approach to instruction and it comprises a suitable mix of learning modes.

- ❖ Face-to-face lecture delivery and support;
- ❖ Reference books;
- ❖ Video lectures on YouTube, Facebook and twitter;
- ❖ Web-based learning system support;
- ❖ Interactive virtual class supports;
- ❖ Assignments, Laboratory/ Sessional;
- ❖ Project work.

Tutorial Service and Study Center

In BOU system, all classes are arranged in the particular institutions. An institution selected by the BOU for counseling is called a study center (SC). In BOU system, tutorial class is optional. Learner's come to the study center to solve their course-related problems and to get necessary information of the program. Due to the technology-based program, huge numbers of practical/ laboratory/ sessional are included in the syllabus, so learners are advised to attend in the tutorial class regularly.
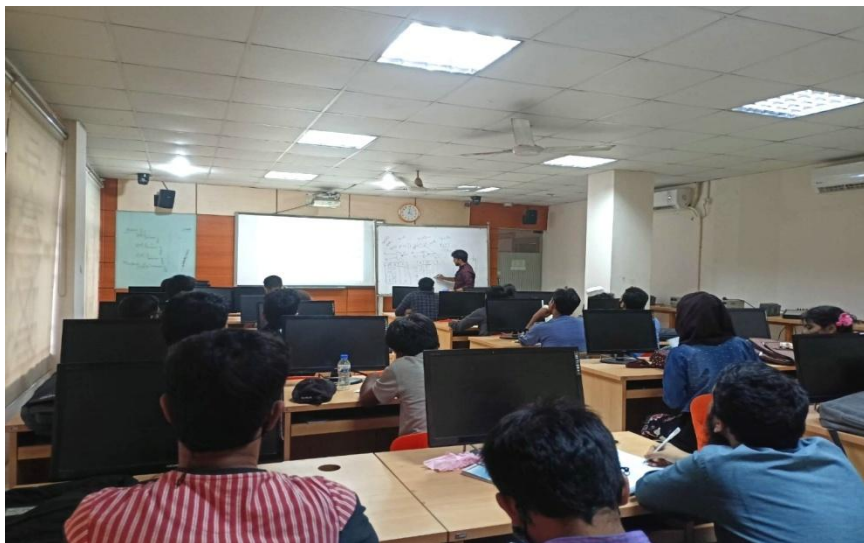
Learners in the classroom

Who is your Tutor?

According to the BOU concept, a teacher who delivers lectures and provides tutorial services is called a 'Tutor'. For each course, there is tutor in a study center, who is selected by the BOU authority. For present program, faculties of BOU and faculties of different study centers will be Tutors of the program. They deliver lectures, course and tutorial service-related information, evaluate assignments and conduct examinations.

How will you contact the Tutor?

For any query about tutors and tutorial services, you may contact with respective study centre coordinator. For any problem don't hesitate to contact the Dean's office of the School of Science and Technology (SST), BOU, Gazipur, Tel:9291111.
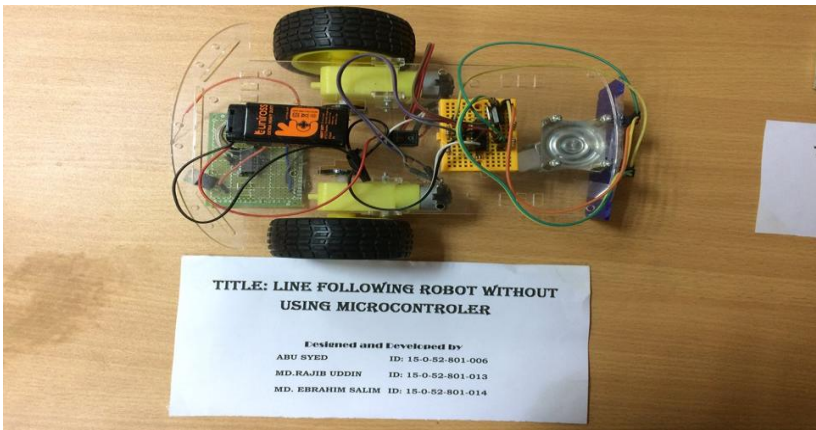

Software Lab Room

Students performing lab work

Demonstrate various project works

Robot without Microcontroller
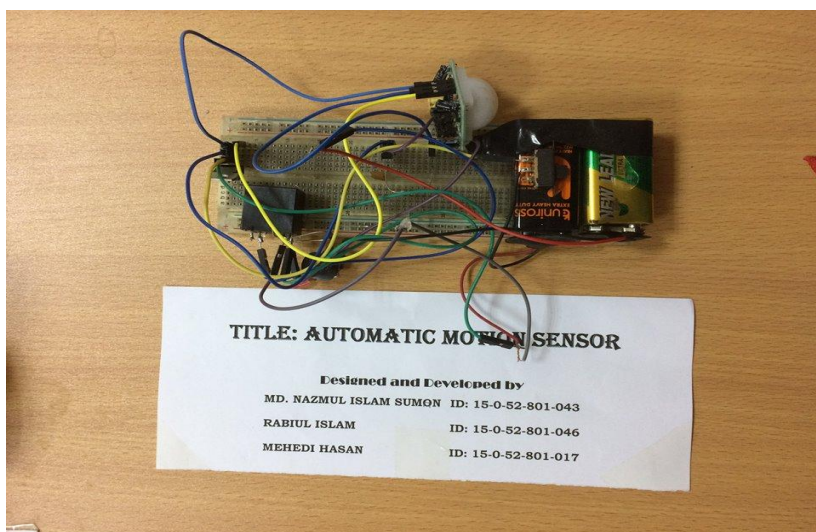
Automatic Motion Sensor

Is it Necessary to Attend in the Tutorial Classes?

The program is a technical and practical based, so learners are advised to attend in the tutorial class regularly. A log book will be provided from the School of Science and Technology, BOU for recording both the theoretical and practical/ laboratory/ sessional hours. It must be preserved by the course tutors.The log book further be submitted to Dean, SST, BOU at the end of each semester for evaluation. Keep in mind that *10% marks is allocated for participation in tutorial sessions for laboratory courses and 5% for theory courses.*

Tutorial Class Time

The tutorial classes are conducted as per academic calendar of the program. We advise learners to follow the academic calendar and class schedule. Before attending the tutorial class, please go through your course material as per the session schedule and make a plan of the points to be discussed. Unless you have gone through the Units, there may not be much to discuss and may not be fruitful.

Photo Gallery

Conducting orientation & fresher's program (session 2015-2016)

Orientation & Fresher's Program (session 2021-2022)

During admission test of CSE program

BOU Coach &Participants at National Programming Competition

BOU Participants with Judge at National Programming Competition

Astronomy Seminar 2017

Performing lab work at digital lab

Conducting seminar

Study tour at AEC, Savar

Learning session in Microbiology lab at AEC

Delicious launch at AEC's Dining Hall

Visiting different laboratories in AEC, Savar
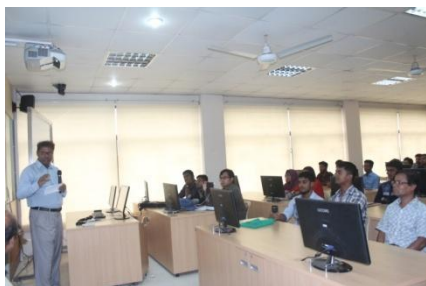
Regular Scientific Seminar

Welcoming of chief guest in the Orientation & Fresher's Reception

Orientation & Fresher's Reception-2017

Student's Address at Orientation & Fresher's Reception-2017

Anchoring team

Photo session after cultural program

BOU's students' participation in the Inter-university Poem Recitation Competition-2016

An Attractive Scene of Drama 'Takar Apad'

A remarkable scene from Drama 'Takar Apad'

A Charming Scene of Drama 'Takar Apad'

Annual Study Tour & Picnic-2018 at BARD, Comilla

Photo Session at War Symmetry, Comilla

Photo Session at BARD, Comilla

Raffle draw at Annual Picnic

Demonstration of Project work (Learners of 1st year 2nd semester)

Lab work of Digital Logic Design course

A project was done by the learners

Learners in outdoor games

EVALUATION PROCEDURE

To complete a course a learner shall be required to go through an evaluation procedure. The performance of a learner in each course (Theoretical, Practical/ Laboratory/ Sessional) shall be evaluated based on a scheme of continuous assessment and semester final examination. The 40% marks are considered pass of a course provided that student(s) must appear in the semester final examination of a course(s) and must obtain 10% marks of that course(s) of the semester final examination.

For theory courses the continuous assessment shall be evaluated through a set of quizzes, class tests, class evaluation, class participation, homework assignment, case study and seminar/presentation;

❖ For laboratory courses, the continuous assessments shall be evaluated by the performance of the learner during laboratory hours, class participation, assignments, class test, notebook on experiments, viva-voce during laboratory hours and quizzes.

Distribution of Marks

Theory Courses

(i) Total one hundred marks are allotted for each course. Thirty percent (30%) of the marks shall be allotted for continuous assessment and seventy percent (70%) for semester final examination. The distribution of marks for each course is as follows:

Category	Marks%
Class Attendance	5%
Assignment/Case study	10%
Quizzes/Class test	15%
Semester Final Examination	70%
Total	100%

(ii) The number of assignment/case study of a course shall be at least three (3) in each course. Average marks shall be considered as final assignment marks.

(iii) At least two midterm/quizzes/class tests shall be conducted for each course. Average marks shall be considered as final midterm/quizzes/class test marks and added to the final score.

(iv) The basis of awarding marks for class attendance shall be as follows:

Attendance	Marks
90% and above	5
80% to less than 90%	4
70% to less than 80%	3
60% to less than 70%	2
50% to less than 60%	1
Less than 50%	0

Laboratory Courses

(i) Total one hundred marks are allotted for each course. Forty percent (40%) of the marks shall be allotted for continuous assessment and sixty percent (60%) for semester final examination. Distribution of marks for each course is as follows:

Category		Marks%
Class attendance		10%
Lab performance		10%
Assignment/case study		10%
Quizzes/class test		10%
Semester Final Examination		60%
Problem-solving/Lab test	40	
Viva-voce	10	
Notebook on experiment/Lab report	10	
Total		100%

(v) Number of assignment/case study of a course shall be at least three (3) in each course. Average marks shall be considered as final assignment marks.

(vi) At least two midterm/quizzes/class tests shall be conducted for each course. Average marks shall be considered as final midterm/quizzes/class test marks and added to the final score

(ii) Basic of awarding marks for class attendance shall be as follows:

Attendance	Marks
90% and above	10
85% to less than 90%	9
80% to less than 85%	8
75% to less than 80%	7
70% to less than 75%	6
65% to less than 70%	5
60% to less than 65%	4
55% to less than 60%	3
50% to less than 55%	2
Less than 50%	0

Project Work

(i) The learners shall certify that the project was done by her/him and that has not been submitted elsewhere or for any other degree or diploma

(ii) Total one hundred marks are allotted for Project Work. Distribution of marks is as follows:

Category	Marks%
Project Supervisor	30%
Evaluation of Project Work	40%
Presentation	30%
Total	100%

(iii) There shall be an evaluation committee for evaluating the project that shall consist of two members. The examination committee of the relevant semester shall recommend the names of the member for approval of the Vice-Chancellor. This approval will be reported to the Academic council. The evaluation committee shall be constituted as follows.

Serial	Category	Position
1.	Chairman of the examination committee of the relevant semester	Chairman
2.	One expert member and not below the rank of an Associate Professor	Member

(iv) If a member is unable to accept the appointment or has to relinquish his appointment before conducting the project evaluation, the Vice-Chancellor shall appoint another member in his place on the recommendation of the Examination Committee of the relevant semester. The appointment will be also reported to the Academic Council.

Comprehensive Viva Voce
(i) Total one hundred marks are allotted for Comprehensive Viva Voce.
(ii) There shall be an Examination Board for conducting the Comprehensive Viva-Voce that shall consist of at least five members.

Continuous Assessment Report
(i) The respective course teacher/tutor shall conduct the in-course mid-semester/class test/class performance/assignment respectively.
(ii) All class tests, assignments, presentations; class performance will be evaluated by the course teacher or faculty of BOU. At the end of the syllabus of each course, s/he shall calculate the total number of continuous assessment, class participation marks and prepare a marks sheet. S/he shall submit the same to the chairman of the respective examination committee as well as to the Controller of the Examination of BOU before the start of the semester final examination.
(iii) The course teacher shall also submit the class attendance report with the register/documents to the chairman of the respective examination committee.

Semester Final Examination
Semester Final Examination will be conducted by Bangladesh Open University.

Pattern of Question Paper
The question shall be set including short type, problem-solving and analytical (depending on the nature of the course) and have to answer 5 out of 7 questions.

Time: 3 Hours   Marks: 70
5 out of 7 - 5×14 marks = 70 marks

Laboratory Question
Distribution of the laboratory works among the learners will be done by the external and internal examiner during the examination with the help of the question paper supplied by the respective examination committee.
Time: 3 Hours   Marks: 60

Re-evaluation of Answer Script
Re-evaluation of any answer script shall not be allowed.

Grading System

Each course has a certain number of credits, which describes its corresponding weight. A learner'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 to qualify for the degree. Letter grades and corresponding grade points are given as follows.

Numerical Grade	Letter Grade	Grade Point
80% or above	A+	4.0
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.5
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.0
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.5
45% to less than 50%	C	2.25
40% to less than 45%	D	2.0
Less than 40%	F (Fail)	0.0

Calculation of Cumulative Grade Point Average (CGPA)

A learner will get an individual GP for every completed course. In choosing of completion of a number of courses, the 'Grade Point Average' (GPA) of those completed courses will be calculated by using the following formula where the individual GP of courses and the respective credit of those courses will be taken into consideration.

The GPA is calculated as follows:

$$GPA = \frac{\sum(Credits\ passed \times grade\ point\ value)}{Total\ credit\ of\ all\ courses\ attempted}$$

Upon successful completion of the program requirements, the CGPA of the learner will be calculated by using the following formula.

$$CGPA = \frac{\sum(Credits\ of\ courses\ passed \times grade\ point\ earned\ in\ the\ course)}{Total\ credit\ of\ the\ program}$$

Repeat/ Improvement

The repeat/improvement course(s) will be guided by the following rules.

(a) Learner earning 'F' grade in any course shall be required to improve the grade when offered in the subsequent semester(s), since achieving a passing grade ('D') by paying the necessary re-examination fee(s).

(b) A learner earning a 'B-' (B minus) grade or below may also choose to improve the grade when offered in the subsequent semester(s) by paying also necessary re-examination fee(s). The following rules will apply in these regards:

(i) Improvement opportunities shall be once only for each course. Otherwise, the learner shall have to pay twice the normal re-examination fee for a course. However, improvement of a course shall not be allowed after graduation.

(ii) In the case of failure to improve her/his grade after the course improvement examination, the previous grade shall remain valid.

(c) In both the cases stated in (a) & (b), the learner shall not require to submit assignments/quizzes/class tests, if submit once.

(d) Learners having 'F' grade in any course/courses or having courses/courses still incomplete will get an opportunity for registration of maximum 12 credits from the previous semester(s) in subsequent semester(s). on the contrary, the outgoing learners having 'F' grade in maximum 20 credits or having course(s) still incomplete, may be allowed to register for the subsequent semester(s) to complete the degree.

Requirement for obtaining 'B.Sc in CSE Degree

(i) Complete 148 credits successfully;

(ii) Obtain a minimum grade of 'D' in each course;

(iii) Secure a minimum 'Cumulative Grade Point Average(CGPA)' of 2.5;

(iv) Complete the program within eight academic years of her/his first admission year in the program.

Detail Syllabus

First Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
ENG1131	**Communicative English**	**3.0**

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Listening and responding to video lectures/talks; Listening to specific task-focused audio tracks; Watching videos/documentaries and responding to questions based on them; Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV;

Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family/friend; Describing a simple process (filing a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Responding to questions - Different forms of interviews - Speaking at different types of interviews; Giving impromptu talks, Making presentations on given topics;

Reading - Skimming a reading passage – Scanning for specific information - Note-making; Critical reading - Finding key information in a given text - Sifting facts from opinions; Reading and interpreting visual material; Making inference from the reading passage - Predicting the content of a reading passage; Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email;

Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause 10 & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Creative writing, Poster making;

Grammar - Prepositions - Reference words – Wh - questions - Tenses (Simple); Use of imperatives - Subject-verb agreement; Tenses (Past) - Use of sequence words - Adjectives; Adverbs – Tenses – future time reference; Direct and indirect speech;

Vocabulary - Word formation - Word expansion (root words / etymology); Compound words - Word Association; Different forms and uses of words, Cause and effect words; Single word substitutes - Use of abbreviations & acronyms; Lexical items (fixed / semi fixed expressions);

Books Recommended:
  (i) Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012.
  (ii) S.P. Dhanavel, English and Communication Skills for students of Science and Engineering. Oriented Black Swan, Chennai, 2011
  (iii) Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. Technical English: Writing, Reading and Speaking. New York: Longman, 2001.
  (iv) Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.

COURSE CODE	COURSE TITLE	CREDIT
PHY1132	**Wave, Optics and Thermodynamics**	3.0

Waves: Waves on a String, Transverse and longitudinal waves, The wave equation, Phase velocity, The sine wave, Power transmission, Superposition principle, Interference, Standing waves and Resonance, Sound waves, Wave speed (without derivation), Displacement and pressure waves, Beats, Doppler effect for sound waves.

Optics: Huygen's Principle (eg. in Refraction), The electromagnetic wave, Coherence, Young's experiment, Intensity in double slit interference, Thin film interference (including wedge films and Newton's rings), The Phasor Method, Single slit diffraction, The diffraction grating. Total internal reflection: mechanism of wave propagation and applications.

Heat and Thermodynamics: Temperature, Heat and the First Law Measuring temperature, Constant Volume gas thermometer, Ideal gas temperature, Measurement of thermodynamic temperature, Absorption of heat by solids and liquids, Molar specific heat, Heat and Work, Calculation of work done by an ideal gas at constant temperature, Differential form of First Law of Thermodynamics and application to selected cases, Kinetic Theory of Gases, RMS speed, pressure, translational kinetic energy and pressure, Adiabatic equation of an ideal gas, Entropy and the Second law of Thermodynamics, Heat engines and refrigerators

Books Recommended:
  (i) Walker, J., & Halliday, D. (2008). Fundamentals of physics (8th ed.). Hoboken, NJ: Wiley.
  (ii) Tipler, P., & Mosca, G. (2008). Physics for scientists and engineers (6th ed.). New York, NY: W.H. Freeman.

COURSE CODE	COURSE TITLE	CREDIT
BUS1123	**Introduction to Business**	**2.0**

The Business: Its Nature and Scope: Meaning of Business, Characteristics of Business, Objectives of Business, Requisites of a Successful Business, Scope of Business, Difference between Business and Profession, Iner-relationship between Industry, Commerce and Trade.

Ownership Structure: Proprietorship, Partnership, Company, Cooperative, Selection of an Appropriate Form of Ownership Structure, Ownership Pattern in Small-Scale Enterprises in Bangladesh.

General and Human Resource Management: Meaning of Management, Characteristics of Management, Difference between Management and Administration, Scope of Management, Functions of Management, Management Process, Manpower Planning, Motivation, Job Recruitment, Selection, Training and Development, Remuneration and Benefits.

Financing of Enterprise: Need for Financial Planning, Sources of Finance, Capital Structure, Term-Loans, Sources of Short-term Finance, Capitalization, Venture Capital, Export Finance., Working Capital- Significance of Working Capital, Assessment of Working Capital, Factors Determining Requirements of Working Capital, Sources of Working Capital, Management of Working Capital.

Production and Operation Management: Investment Analysis, Plant Location, Plant Layout, Product Design, Production Design, Quality Control, Small Business Technology,Inventory Management- Concept of Inventory, Motive of Holding Inventories, Benefits of Holding Inventories, Objectives of Inventory Management, Models of Inventory Management.

Marketing Management: Concept of Marketing, Problems of Marketing, Market Assessment, Market Segmentation, Marketing Mix, Branding and Packaging, pricing Policy, Distribution Channels or Methods of Marketing.

Accounting: Meaning and Process of Accounting, Users and Uses of Accounting, Distinction between Book-keeping and Accounting; Accounting Profession, Conceptual Framework of Accounting; Generally Accepted Accounting Principles(GAAP), Basic Accounting Equation, Accounting Cycle, The Account, Double Entry System, Debit and Credit Procedures, Steps in the Recording Process, Financial Statements, Cost and Management Accounting.

Text Books:
  (i) Khanka, S. S. (2004). *Entrepreneurial Development* (4th Edition). New Delhi: S. Chand & Company Ltd.

(ii) Weygandt, J.J. Kieso, P.D. and Kimmel, D.E.(2015).*Accounting Principles*(12th Edition). John Wiley & Sons Inc.

(iii) H. Garrison, R., W. Noreen, E., & C. Brewer, P. (2010). Managerial Accounting (13th ed.). McGraw Hill.

(iv) Weygandt, J., & Kimmel, P. (n.d.). Accounting principles (11e [edition]. ed.).

(v) Larson, K. (1993). Fundamental accounting principles (7th Canadian ed.).

COURSE CODE	COURSE TITLE	CREDIT
MAT1134	**Differential and Integral Calculus**	3.0

Functions and Models: Exponential Functions, Inverse Functions and Logarithms

Limits and Derivatives: The Tangent and Velocity Problems, The Limit of a Function, Calculating Limits Using the Limit Laws, The Precise Definition of a Limit, Continuity, Limits at Infinity; Horizontal Asymptotes, Derivatives and Rates of Change, The Derivative of a Function

Differentiation Rules: Derivatives of Polynomials and Exponential Functions, The Product and Quotient Rules, Derivatives of Trigonometric Functions, The Chain Rule, Implicit Differentiation, Derivatives of Logarithmic Functions, Rates of Change in the Natural and Social Sciences, Exponential Growth and Decay, Related Rates, Linear Approximations and Differentials, Hyperbolic Functions

Applications of Differentiation: Maximum and Minimum Values: The Mean Value Theorem, How Derivatives Affect the Shape of a Graph, Indeterminate Forms and L'Hospital's Rule, Summary of Curve Sketching, Optimization Problems, Antiderivatives.

Integrals: Areas and Distances, the Definite Integral, the Fundamental Theorem of Calculus, Indefinite Integrals and the Net Change Theorem, the Substitution Rule

Applications of Integration: Areas between Curves, Volume, Volumes by Cylindrical shells, Work, Average value of function

Books Recommended:
(i) Anton, H., & Bivens, I. (2012). Calculus: Early transcendentals. (10th ed.). Hoboken, NJ: John Wiley & Sons.

(ii) Das, B., & Mukherjee, B. (1949). Differential Calculus (50th ed.). U. N. DHUR & Sons Private.

(iii) Das, B., & Mukherjee, B. (1977). Integral calculus: Including differential equations (23rd ed.). Calcutta: U.N. Dhur.

(iv) Ayres, F., & Mendelson, E. (n.d.). Schaum's outlines calculus (Sixth ed.).

COURSE CODE	COURSE TITLE	CREDIT
EEE1135	**Electricity, Magnetism and Electrical Circuit**	**3.0**

Electrical Charge and Coulomb's Law: Introduction, charge, conductors and insulators, Coulomb's Law

The Electric Field: Fields, the E field, field from point charges, fields from charge distributions, force on charges, electric dipole in an E field

Gauss's Law: Flux of a vector field, electric flux, gauss's law, applications of Gauss's law

Electric Potential: Electric potential energy, potential/field relationships, potential due to point charges and distributions.

The Magnetic Field: B fields, force on moving charge, force on a current, magnetic dipole, Biot-Savart law and applications, Ampere's law and applications.

Magnetic Properties of Matter: Magnetization, magnetic materials, bar magnet, magneto motive force, magnetic flux, magnetic circuit, comparison with electrical circuit.

Circuit Principles: Circuit concept, open and short circuit, series and parallel circuits with characteristics. Circuit laws: KVL, KCL, Voltage & Current divider rules and network theorems: Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem.

AC fundamentals: Equations of alternating voltages and currents, cycle, time period, frequency and amplitude of a wave; phase difference; RMS and average values; AC through resistance, Inductance and capacitance only. Series LRC circuit; Resonance in LRC circuit; impedance & calculation, resonance curve, bandwidth of resonance circuit; parallel ac circuit, simplification of parallel ac circuit. admittance calculation, power calculations, frequency response, and resonance.

Books Recommended:
  (i)   Halliday, D., & Resnick, R. (2002). Physics (latest ed.). Part-II, New York, Wiley
  (ii) Electric circuits, By Joseph Edminister and Mahmood Navi, Schaum's outlines, Tata Mc Grew-Hall, 2012
  (iii) Electrical Technology, Vol. 1: Basic Electronics, B.L. Theraja and A.K. Theraja, 2012
  (iv) Electrical Engineering, B.L. Theraja and A.K. Theraja, 2012

COURSE CODE	COURSE TITLE	CREDIT
EEE11P6	**Electricity, Magnetism and Electrical Circuit Lab**	**0.75**

Experiment	Topics
01	Determine the value of an unknown resistance and to verify the laws of series and parallel resistances by using a Wheatstone bridge principle.
02	Determine the electrochemical equivalent of copper voltmeter.
03	Verification of Thevenin's Theorem.
04	Verification of Superposition Theorem.
05	Study of Signal generator and Oscilloscope.
06	Phase shift measurement of R-C circuit.
07	Phase power measurement by two Watt-meter method.
08	Determine the ratio of the horizontal component of the earth's magnetic field and the magnetic moment by employing a magnetometer.
09	Resistance measurement with color coding.

COURSE CODE	COURSE TITLE	CREDIT
CSE1127	**Computer Fundamentals**	**2.0**

Introduction to Computer System: Characteristics of Computer, Generation of Computer, Classification of Computer, Architecture of Computer System.

Number System: Commonly Used Number System, Decimal, Binary, Octal, Hexadecimal, Converting from One number system to another.

Binary Arithmetic: Binary addition, Binary subtraction, Binary multiplication, Binary Division, Representation of Characters - BCD - EBCDIC- ASCII, Representation of Integers in Computer, 1's Complement Representation, 2's Complement Representation, The r's and (r-1)'s Complement Representation of Real Number in Computer System.

Input Output Devices: Offline and Online Input Devices, Keyboard devices, Point and Draw devices, Data Scanning devices, Digitizer, Electronic cards based Devices, Speech Recognition Devices, Vision-based Devices, Monitor, Printer, Plotters, Screen Image Projector, Voice Response Systems.

Storage Devices: Primary Memory - Different Types of RAM, ROM, Cache Memory, Secondary Storage Devices - Magnetic Tape, Magnetic Disk, Floppy Disk, Hard Disk, CD/DVD ROM.

Processor: Internal Structure of Processor, Different Types of Processor, Processor Speed, and Concept of Instruction Set.

Algorithms and Flowcharts: Algorithms and its Characteristics, Flowchart, Different symbols used in Flowcharts, Advantages and Disadvantages of Flowcharts.

Computer Language: machine Language, High-Level Language, Assembly Language.

Software: Types of Software, Relationship between Hardware and Software, Different Ways of Acquiring Software, Steps to Develop Software, Firmware, Middleware.

Operating System: Types of Operating Systems, Single user - Multi-user, Multi-tasking, Multi-programming, Multi-processing, Time sharing, Real-Time Operating Systems.

Data Communication and Computer Networks: Basic elements of communication system, Data Transmission Techniques, Types of Computer Networks, Communication Protocols, Internetworking Tools, Characteristics of Distributed Data Processing.

Internet: Evolution and Basic services on the Internet, World Wide Web, Browsers, Uses of the Internet.

Books Recommended:
   (i)   Norton, P. (2006). Peter Norton's Introduction to Computers (6th ed.). New York: Glencoe/McGraw-Hill.
   (ii) Sinha, P. (2010). Computer fundamentals (4th ed.). New Delhi: BPB Publications.
   (iii) Rahman, M., & Hossain, M. (n.d.). Computer Fundamentals. Systech Publications, Dhaka: 2002.

COURSE CODE	COURSE TITLE	CREDIT
CSE11P8	**Computer Fundamentals Lab**	**0.75**

Experiment	Topics
01	Creating, opening, closing, saving and editing a word Document.
02	[MS-WORD] Insert header and footer in the document.
03	[MS-WORD] Create a link between two files using Hyperlink.
04	[MS-WORD] Create a mail - merge and add data of 5 recipients.
05	[MS-WORD] Protect a document.
06	[MS-WORD] Implement macro.

07	[MS-POWERPOINT] Create duplicate slides in PowerPoint. Give an example.
08	[MS-POWERPOINT] Make a master slide.
09	[MS-POWERPOINT] Design a chart of population.
10	[MS-POWERPOINT] Insert Animation.
11	[MS-POWERPOINT] Insert a background in PowerPoint.
12	[MS-EXCEL] How you can filter your data.
13	[MS-EXCEL] Sort data in ascending and descending order.
14	[MS-EXCEL] To show the use of goal seeks.
15	[MS-EXCEL] To show the use of scenarios.
16	[MS-EXCEL] Perform any 5 Date and Time functions.
17	[MS-EXCEL] Perform any 5 Math & Trig functions.
18	[MS-ACESS] With the help of Wizard create table having 5 elements.
19	[MS-ACESS] Create a query in design view.
20	[MS-ACESS] Make an admission form using design view in MS-Access.
21	[MS-ACESS] Create a relationship b/w two tables.

First Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT1231	**Linear Algebra and Differential Equations**	**3.0**

First-Order ODEs: Classification, existence and uniqueness; Slope fields; Separable and Linear 1st order; Exact equations and equations and other methods to and analytic solutions.

Mathematical Models and Numerical Methods: Population modeling; Equilibrium solutions and their stability; Models from physics.

Linear Systems and Matrices: Matrices and Gaussian elimination; Row operations; inverses of matrices and determinants.

Vector Spaces: Vector spaces and subspaces; Linear independence, bases and dimension; Row and column spaces for matrices.

Higher-Order Linear ODEs: Second order linear equations; General solution of linear equations; Equations with constant coefficients; Mechanical vibrations.

Eigen values and Eigenvectors: Eigen values and eigenvectors; Diagonalizing matrices

Homogeneous Linear Systems of ODEs: First order systems; Eigen value methods for linear systems; Mechanical applications.

Inhomogeneous Linear Systems of ODEs: Matrix exponentials; Inhomogeneous linear systems.

Nonlinear Systems: Phase plane; nonlinear applications.

Book References:
   (i) Edwards, C., & Calvis, D. (2010). Differential equations and linear algebra (3rd ed.). Upper Saddle River, NJ: Pearson Education.
   (ii) Zill, D., & Wright, W. (2013). Differential equations: With boundary-value problems (8th ed.). Boston, MA: Brooks/Cole, Cengage Learning.
   (iii) Boyce, W., & DiPrima, R. (2009). Elementary differential equations and boundary value problems (9th ed.). Hoboken, NJ: Wiley.
   (iv) Anton, H., & Rorres, C. (2011). Elementary Linear Algebra: With Supplemental Applications (10th ed.). New York: Wiley.
   (v) Lipschutz, S., & Lipson, M. (2013). Schaum's outlines linear algebra (5th ed.). S.l.: McGraw-Hill Education.

COURSE CODE	COURSE TITLE	CREDIT
HUM1222	**Bangladesh Studies**	**2.0**

Sources of History: Brief geo-political and socio-economic history of Ancient Bengal. The nature of origin, and development of Bengal Civilization.

Liberation War of Bangladesh: The socio-political and economic context of the Liberation War of Bangladesh and the background of the emergence of Bangladesh as an Independent Country.

The major socio-Economic and Cultural Features of Bangladesh

Agricultural Development: Agricultural Development and the Contribution of the agricultural sector to the national economy and Society of Bangladesh; An Overview of agricultural policies of Bangladesh.

The process of Industrialization: the evolution of industrial growth in Bangladesh: sector-wise development of industries; the role of private and public sectors in industrial development; an overview of industrial policies of Bangladesh.

Development of Public and Private sector in Bangladesh: The contribution of the private sector in the economy of Bangladesh; An Overview of Private sector development policy in Bangladesh; The opportunities and Challenges of Private sector development; The role of Foreign Investors and Development Partners(FIDP) in private sector development.

The Political and Government system: The form of Government; Bureaucracy as a system of administration; the role of political parties in sustaining modern democracy.

Books Recommended:
  (i) Sirajul Islam - History of Bangladesh 1704-1971, Asiatic Society of Bangladesh.
  (ii) Khan A.R. & M. Hassain -Development Strategy for Bangladesh.

COURSE CODE	COURSE TITLE	CREDIT
EEE1233	**Electronic Device and Circuits**	**3.0**

Semiconductor Devices: PN-Junction Diode- Drift and Diffusion Current, Diode: biasing, construction andV-I curve analysis, Zener Diode-Zener Regulator-BJTVI, Characteristics-CE Configuration-Current Equation

h-Parameter Model. Current Equation- Transconductance MOSFET-Types DMOS, EMOS – V-I Characteristics-Moll Current Equation.

Rectifiers and Transistors: Half and full wave rectifiers: construction and application BJT, UTJ, JFET: construction, application and analysis, the concept of negative resistance, JFET-V-I Characteristics-

Amplifiers and Oscillators: Filter-Capacitance Input Filter-Choke Input Filter – CE Amplification with and without feedback – Analysis and Frequency Response – CS MOSFET Amplifier – Analysis

Operation Amplifier: Introduction of an Inverting Amplifier, Non-Inverting Amplifier, Basic Application of Operation Amplifier: Subtractor, Summing Amplifier, Analog to Digital Converter, Digital to Analog Converter, Low Pass Filter, First Order Low Pass Filter, First Order High Pass Filter, Integrator, Differentiator.

Books Recommended:
(i) Bell, D., & Bell, D. (2008). Fundamentals of electronic devices and circuits (5th ed.). Don Mills, Ont.: Oxford University Press.
(ii) Electrical Technology, Vol. 1: Basic Electronics, B.L. Theraja and A.K. Theraja, 2012
(iii) Paynter, R. (2006). Introductory electronic devices and circuits: Electron flow version (7th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
(iv) Boylestad, R., & Nashelsky, L. (2013). Electronic devices and circuit theory (11th ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
EEE12P4	Electronic Device and Circuits Lab	1.5

Experiments	Topics
1	P-N Junction Diode Characteristics
2	Zener Diode Characteristics and Zener Diode as a Voltage Regulator
3	Transistor Common-Base Configuration Characteristics
4	Transistor Common-Emitter Configuration Characteristics
5	Half-Wave Rectifier With and Without Filter
6	Full-Wave Rectifier With And Without Filter
7	FET Characteristics
8	h-Parameters of CE Configuration
9	Frequency Response of CE Amplifier
10	Frequency Response of CC Amplifier
11	Frequency Response of Common Source FET Amplifier
12	Silicon-Controlled Rectifier (SCR) Characteristics
13	UJT Characteristics

COURSE CODE	COURSE TITLE	CREDIT
CSE1235	**Digital Logic Design**	**3.0**

Boolean Algebra and Logic Gates: Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations.

Combinational Logic: Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of Combinational Circuits.

Synchronous Sequential Logic: Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

Asynchronous Sequential Logic: Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

Memory and Programmable Logic: RAM and ROM – Memory Decoding – Error Detection and Correction – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices – Application Specific Integrated Circuits.

Books Recommended:
- (i) Mano, M., & Ciletti, M. (2013). Digital design: With a introduction to the verilog hdl (5th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
- (ii) Wakerly, J. (2006). Digital design: Principles and practices (4th ed.). Upper Saddle River, N.J.: Pearson/Prentice Hall.
- (iii) Roth, C., & Kinney, L. (2014). Fundamentals of logic design (7th ed.). Stamford, CT: Cengage Learning.
- (iv) Givone, D. (2003). Digital principles and design (1. ed., internat. ed.). Boston, Mass. [u.a.: McGraw-Hill.
- (v) Kharate, G. (2012). Digital electronics. New Delhi: Oxford University Press.

COURSE CODE	COURSE TITLE	CREDIT
CSE12P6	**Digital Logic Design Lab**	**1.5**

Experiments	Topics
01	Implementation of Basic Logic Gates : AND, OR, NOT
02	Implementation of Logic Gates : NOR, NAND, X-OR, X-NOR

03	Verification of De Morgan's theorem and Logic circuits
04	Implement Half Adder & Full Adder Circuit
05	Implement of BCD adder circuits,
06	Test & Verification of S – R , J – K, T, D Flip-Flop circuit
07	Implementation of Asynchronous Up & Down counter
08	Implementation of Synchronous Up & Down counter
09	Design and Implementation of BCD counter.
10	Test of IC of Encoder & Decoder
11	Test of IC of Multiplexer and De-multiplexer
12	Operation of seven segment display &Design of Digital Lock
13	Conversion of A/D and D/A

COURSE CODE	COURSE TITLE	CREDIT
CSE1237	**Structured Programming Language**	3.0

Introduction to Problem Solving: Flow charts, Tracing flow charts, Problem solving methods, Need for computer Languages, Sample Programs written in C

C Language preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants

Input-Output: getchar, putchar, scanf, printf, gets, puts, functions.

Pre-processor commands: #include, #define, #ifdef

Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators

Control statements: While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, comma operators

Storage types: Automatic, external, register and static variables.

Functions: Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions

Arrays: Defining and processing, Passing arrays to a function, Multi dimensional arrays.

Strings: Defining and operations on strings.

Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers, Function pointers.

Structures: Defining and processing, Passing to a function, Unions, typedef, array of structure, and pointer to structure

File structures: Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow of handling.

File Handling: File operation: creation, copy, delete, update, text file, binary file.

Books Recommended:
   (i)   Venugopal, K., & Prasad, S. (2007). Mastering C. New Delhi: Tata McGraw-Hill Publishing Company Limited.
   (ii) Schildt, H. (2000). C, the complete reference (4th ed.). Berkeley: Osborne/McGraw-Hill.
   (iii) Kernighan, B., & Ritchie, D. (1988). The C programming language (2nd ed.). Englewood Cliffs, N.J.: Prentice Hall.
   (iv) Kanetkar, Y. (2008). Let us C (8th ed.). Hingham, Mass.: Infinity Science Press.
   (v)   Schildt, H. (1997). Teach yourself C (3rd ed.). Berkeley: Osborne McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE12P8	**Structured Programming Language Lab**	**1.5**

Experiments	Topics
1	Practice of writing different simple program like area of a circle, triangle, polygon, temperature conversion etc.
2	Implement Branching: The IF statement (break and continue statement), Branching: SWITCH statement, GOTO statement
3	Implementation of Looping: FOR statement (break and continue)
4	Implementation of Looping: WHILE and DO WHILE statement
5	Implementation of Library Functions
6	Implement Argument Passing and Value Receiving, Functions: Pass-by-value, Pass-by-reference
7	Value Receiving Functions: Command Line Parameter and, Arrays: Initialization, Access, Passing and Receiving
8	Arrays: 2D handling, Arrays:, String Handling , Structure: Initialization, Access, Passing and Receiving, Structure:, Union and Bit-fields
9	Implementation of Structures and Sorting and Searching program
10	Write program to handle Pointers.
11	Compiler and Linker, Segment and Memory Model, Video Adapter, Modes, Graphics Initialization, Graphics Functions
12	Write program for Text File Handling, Binary File Handling, Data File Management

Second Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT2131	**Coordinate Geometry and Vector Analysis**	3.0

Coordinate & Polar System:
Axis, Change of axis (Rotation) Distance, Straight line, circle
Polar Equation of conics (Two and Three Dimension):
Polar coordinate system, Distance between two points, Polar equation of a Straight line, Polar equation of a circle, Polar equation of a conic, Chords, Tangent and Normal to a conic, Chord of contact, Polar of a point.
Vector Algebra and its Applications to geometry (Plane and Straight Line):
Triple product, Reciprocal vectors, Product of four vectors. General equation of a Plane, Normal and Intercept forms, two sides of a plane, Length of perpendicular from a point to a plane, Angle between two planes, System of planes.
Direction Cosines and Direction ratios of a lie, Projection on a straight line, Equation of a line, Symmetrical and unsymmetrical forms, Angle between a line and a plane, Coplanar lines, Lines of shortest distance, Length of perpendicular from a point to a line, Intersection of three planes, Transformation of coordinates.
Vector Differentiation:
Ordinary differentiation of vectors, Applications to mechanics, Velocity and Acceleration, Differential operator-Del, Gradient, Divergence and Curl,
Vector Integration: Line, Surface and volume integrals, Simple applications of Gauss divergence theorem, Green's theorem and Stokes theorem.

Books Recommended:
1.A text book on of *coordinate geometry with vector analysis* ,A.F.M. Abdur *Rahman*, P.K. *Bhattacharjee*.
2.Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, McGraw Hill.
3.N. Saran and S. N. Nigam: Introduction to vector analysis Pothishala Pvt. Ltd. Allahabad.
4.Shanti Narayan: A text book of vector calculus, S. Chand & co. New Delhi.
5.P. N. Pandey: Polar Coordinate Geometry, Sharda Academic Publishing House, Allahabad.
6.P. K. Jain and Khalil Ahmed: A textbook of Analytical Geometry,Wiley Eastern pub, New Age.

COURSE CODE	COURSE TITLE	CREDIT
CHE2122	**Chemistry**	2.0

Atomic structure, quantum numbers, electronic configuration, and periodic table. Properties and uses of noble gases. Different types of chemical bonds and their properties. Defects in solid; Semiconductors: Structures of Si, Ge, B, N, P,

In. Types of Semiconductor, Electronic and band theory. Chemical Bonding: Valence bond theory, molecular orbital theory, metallic bonding, hydrogen bonding, theory of resonance. Molecular structure of compounds. Selective organic reactions. Different types of solutions and their compositions. Phase rule, phase diagram of monocomponent system. Properties of dilute solutions. Thermochemistry, chemical kinetics, chemical equilibria. Ionization of water and pH concept. Electrical properties of solution.

COURSE CODE	COURSE TITLE	CREDIT
CSE2133	**Discrete Mathematics**	**3.0**

Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.
Sets and Functions: Sets, Set Operations, Functions, Sequences and Summations, Cardinality of Sets, Matrices.
Algorithms: Algorithms, the Growth of Functions, Complexity of Algorithms.
Number Theory and Cryptography: Divisibility and Modular Arithmetic, Integer Representations and Algorithms, Primes and Greatest Common Divisors, Solving Congruence, Applications of Congruence, Cryptography.
Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness.
Counting: The Basics of Counting, the Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Generating Permutations and Combinations.
Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.
Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

Books Recommended:
(i)   Rosen, K. (2012). Discrete mathematics and its applications (7th ed.). New York: McGraw-Hill.
(ii) Scheinerman, E. (2013). Mathematics: A discrete introduction. Boston, Mass.: Brooks/Cole.
(iii) Goodaire, E., & Parmenter, M. (2006). Discrete mathematics with graph theory (3rd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.
(iv) Roman, S. (1989). An introduction to discrete mathematics (2nd ed.). San Diego: Harcourt Brace Jovanovich.

(v) Epp, S. (2011). Discrete mathematics with applications (4th ed.). Boston, MA: Brooks/Cole:.

(vi) Lipschutz, S., & Lipson, M. (1997). Schaum's outline of theory and problems of discrete mathematics (2nd ed.). New York: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE2134	**Computer Architecture and Organizations**	**3.0**

Fundamentals of a Computer System: Functional Units of a Digital Computer – Hardware – Software Interface –Translation from a High Level Language to the Hardware Language – Instruction Set Architecture – Styles and features – RISC and CISC Architectures – Performance Metrics – Amdahl's Law – Case Studies of ISA.

Basic Processing Unit: Components of the Processor – Datapath and Control – Execution of a Complete Instruction – Hardwired and Micro programmed Control – Instruction Level Parallelism – Basic Concepts of Pipelining – Pipelined Implementation of Data path and Control – Hazards – Structural, Data and Control Hazards –Exception handling.

Advanced Concepts in ILP and Current Trends: Exploitation of more ILP – Hardware and Software Approaches – Dynamic Scheduling – Speculation – Compiler Approaches – Multiple Issue Processors. – ILP and Thread Level Parallelism – Current Trends – Multicore Processors – Graphics and Computing GPUs.

Arithmetic for Computers: Addition and Subtraction – Fast Adders – Binary Multiplication – Binary Division – Floating Point Numbers – Representation, Arithmetic Operations.

Memory and I/O: Need for a hierarchical memory system – Types and characteristics of memories – Cache memories – Improving cache performance – Virtual memory – Memory management techniques – Associative memories.

Accessing I/O devices: Programmed Input/output – Interrupts – Direct Memory Access – Interface circuits – Need for Standard I/O Interfaces like PCI, SCSI, USB.

Books Recommended:

(i) Patterson, D., & Hennessy, J. (2009). Computer organization and design: The hardware/software interface (4th ed.). Burlington, MA: Morgan Kaufmann.

(ii) Hamacher, V. (2012). Computer organization and embedded systems (6th ed.). New York, NY: McGraw-Hill.

(iii) Stallings, W. (2013). Computer organization and architecture: Designing for performance (9th ed.). Boston: Pearson.

(iv) Hayes, J. (1988). Computer architecture and organization (2nd ed.). New York: McGraw-Hill.

(v) Hennessy, J., & Patterson, D. (2007). Computer architecture a quantitative approach (4th ed.). Amsterdam: Elsevier/Morgan Kaufmann.

COURSE CODE	COURSE TITLE	CREDIT
CSE2135	**Data Structure**	3.0

Introduction: Elementary Data Structure, Data Structure Operations, Abstract Data Types(ADT), Algorithms Complexity and Time-Space Tradeoff.

Preliminaries: Mathematical Notation and Function, Algorithmic Notation, Control Structure, Complexity of Algorithm, Sub algorithm, Variables, Data Types.

String Processing: Storing Strings, Character Data Type, Strings as ADT, String Operations, Word/Text Processing, Pattern Matching Algorithms.

Arrays, Record and Pointers: Linea Arrays, Arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear Arrays, Inserting and Deleting, Bubble Sort, Linear Search, Binary Search, Multidimensional Arrays, Representation of Polynomials Using Arrays, Pointer Arrays, Dynamic Memory Management, Record Structure, Representation of Records in Memory, Matrices, Sparse Matrices.

Linked List: Representation of Linked List in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation, Garbage Collection, Insertion into a Linked List, Deletion from a Linked List, Header Linked Lists, Circularly Linked Lists, Two Way List, Josephus Problem and Its Solution, Buddy Systems.

Stacks, Queues and Recursion: Array Representation of Stacks, Linked Representation of Stacks, Stacks as ADT, Arithmetic Expressions- Polish Notation, Application of Stacks, Recursion, Tower of Hanoi, Recursion Procedures by Stacks, Queues, Linked Representation of Queues, Queues as ADT, Circular Queues, Deques, Priority Queues, Application of Queues.

Trees: Binary Trees, Representation of Binary Tree in Memory, Traversing Binary Tree, Traversal Algorithms Using Stacks, Header Nodes- Threads, Threaded Binary Trees, Binary Search Trees, Searching and Inserting in Binary Search Trees, Deleting in a Binary Search Trees, Balanced Binary Trees, AVL Search Trees, Insertion in an AVL Search Tree, Deletion in an AVL Search Tree, m-way Search Trees, Searching- Insertion- Deletion in an m-way Search Tree, B-Trees, Searching- Insertion- Deletion in a B-Tree, B+ Trees, Red-Black Trees, Heap, Heap sort, Path Length, Huffman's Algorithm, General Trees, Application of Trees.

Graphs and Their Applications: Graph Theory Terminology, Sequential Representation of Graph - Adjacent Matrix and Path Matrix, Warshall's Algorithm for Shortest Path, Linked Representation of Graph, Operations on Graph, Traversing a graph, Posets - Topological Sorting, Spanning Trees.

Sorting and Searching: Insertion Sort, Selection Sort, Merge Sort, Shell Sort, Radix Sort, Searching and Data Modification, Hashing.

Books Recommended:
  (i) Lipschutz, S. (2014). Data Structures (Revised First edition ed.). McGraw Hill Education.
  (ii) Horowitz, E. (1983). Fundamentals of data structures. New York: W H Freeman.
  (iii) Pai, G. (2008). Data structures and algorithms: Concepts, techniques and applications. New Delhi: Tata McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE21P6	**Data Structure Lab**	**1.5**

Experiments	Topics
01	Array based implementation of stack and queue.
02	Linked list implementations and problems related to linked list such as insertion, deletion, inverting list, concatenation, etc.
03	Linked list based implementation of stack and queue
04	Evaluation of expressions
05	Binary tree traversals
06	Graph traversals
07	Merge sort
08	Quick sort
09	Binary search
10	Binary Heap
11	AVL tree implementation
12	Hash Tables

COURSE CODE	COURSE TITLE	CREDIT
CSE2137	**Object Oriented Programming**	**3.0**

Introduction: Introduction to Procedural Languages – Overview of Language space – Basic Concepts and Syntax – Types, variables, and constants – Scope and extent rules, blocks. – Expressions and Assignment – Program control (if, for, while...) –Intro to Java –Hello World.

Classes: Classes –Instances –Instance variables –declarations (public, private, final, static, etc) –Methods –calling methods –defining –static variables and methods –typical classes (data types, math obj, DB , containers, GUI..etc) – Constructors and Initialization .

Inheritance: Motivation and background –Inheritance in Java: extends – Polymorphism and RTTI. –Downcasting and upcasting –JavaDoc –examples – inner classes –anonymous classes.

Interfaces: Motivation –Interfaces in Java (Interface and Implements) – Interface design and implementation –Multiple inheritances.

OOP Design: Review –OOP as a programming style: manifestos – Encapsulation,Isolation,Abstraction –Separating Interface and Implementation – constructors –destructors (lack of in Java) – Accessors and Mutators (cloning issues on contained instances) –basic OOP design: choosing class and method – Interfaces vs. classes –Polymorphism and downcasting.

Exception Handling: Error handling strategies: return values vs exceptions – Basic Exception Handling –try/catch/finally/throw –Debugging.

I/O Programming: Devices and files –Streams –Programming in Java.

Event-Based Programming: Motivation, multiple input sources. –Basic notions, events, event loop, handlers/callbacks –Event models, Windows, X,Java –UI component events (vs. basic events) –Events in Java 2 (sources, listeners, handlers) –Getting source and data from event.

GUI Programming: Containers, layout, and components –Intro to Java Swing set. –HelloSwing, basic stuff (windowAdaptor) –buttons, text input, etc – containers and layout –list, table widgets.

Network Programming: Intro to IP networks –Sockets –Clients and listeners – Client/server Architectures –Networking Java –Web protocols(HTTP etc) –Web programming in Java –Serialization and Marshaling –RPC –Web sites as RPC's remote objects.

Books Recommended:
  (i)   Horstmann, C., & Cornell, G. (2008). Core Java volume 1 and 2 ([Rev. & expanded 8th ed.). Santa Clara, CA: Sun Microsystems Press.

(ii) Gosling, J. (2014). The Java language specification Java SE 8 edition. Upper Saddle River, NJ: Addison-Wesley.

(iii) Eckel, B. (2006). Thinking in Java (4th ed.). Upper Saddle River, NJ: Prentice Hall.

(iv) Zakhour, S., & Kannan, S. (n.d.). The Java tutorial: A short course on the basics (Fifth ed.).

(v) Deitel, P., & Deitel, H. (2015). Java, how to program – early objects (10. Ed., global ed.). Prentice Hall.

(vi) Horton, I. (2011). Ivor Horton's beginning Java (Java 7 ed.). Indianapolis, IN: John Wiley & Sons.

COURSE CODE	COURSE TITLE	CREDIT
CSE21P8	**Object Oriented Programming - I Lab**	**1.5**

Experiments	Topics
01	Editing, compiling and executing a Java Program using jdk
02	Java classes and objects
03	Java Package With Simple Stack and Queue Class
04	I/O handling
05	Complex Number Manipulation
06	Date Class Similar To Java.Util Package
07	Inheritance, Polymorphism
08	Interfaces and Exception Handling, Packages
09	Creating and executing simple Applets
10	File handling
11	Multi-Threaded programming
12	Implementing Simple Client-Server (Connection oriented and Connectionless)
13	Java graphics programming

Second Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
ECO2221	**Introduction to Economics**	**2.0**

Nature and Scope of Economics: Definition and scopes of Economics; Micro-Economics and Macro- Economics; Positive vs normative Economics; Basic economic problems of every society; Production possibility frontier (PPF).

Basic Elements of Demand and Supply: Law of demand; demand schedule and demand curve; movement along the demand curve and shift of the demand curve; determinants of demand; law of supply; supply schedule and supply curve; determinants of supply; movement along the supply curve and shift of the supply curve; market equilibrium.

Elasticity: Basic idea of elasticity; price elasticity of demand and supply; various types of price elasticity of demand and supply with graphical exposition; cross and income elasticity of demand; measurement of elasticity.

Consumer Behavior: Utility; cardinal utility and ordinal utility; total utility and marginal utility; law of diminishing marginal utility; the idea of indifference curve; indifference map; properties of indifference curve; budget constraint; marginal rate of substitution (MRS) and consumer equilibrium.

Production and Costs: Concept of Production; factors of production and production function; input and output; returns to scale; average, marginal and total product; the concept of total, average and marginal cost; short run and long run cost; fixed and variable costs; the relationship between average and marginal cost; short and long-run average cost.

Theory of Firm: Definition of market; classification of market; characteristics of different markets.

National Income Accounting and Determination: GNP and GDP; real and nominal GNP and GDP; measurement of national income: product, income and expenditure methods; problems of measuring national income in the developing countries.

Books Recommended:
(i) Samuelson, P., & Nordhaus, W. (2005). Economics (18th ed.). Boston: McGraw-Hill/Irwin.
(ii) Roger A. Arnold, Economics, 9th Edition, Thomson Higher Education, 2009.
(iii) Michael Parkin: *Microeconomics*, 5th edition, Addison-Wesley.
(iv) N. Gregory Mankiw: *Principles of Microeconomics*, 4th edition, Cengage Learning.
(v) Parkin, M. (2014). Economics (11th ed.). Boston: Pearson.
(vi) Miller, R. (2014). Economics Today: The macro view. (17TH ed.). Upper Saddle River: Pearson.

COURSE CODE	COURSE TITLE	CREDIT
CSE2232	**Microprocessors and Microcontrollers**	3.0

The 8086 Microprocessor: Introduction to 8086, Microprocessor architecture, Addressing modes, Instruction set and assembler directives, Assembly language programming, Modular Programming, Linking and Relocation, Stacks, Procedures, Macros, Interrupts and interrupt service routines, Byte and String Manipulation.

8086 System Bus Structure: 8086 signals, Basic configurations, System bus timing, System design using 8086, IO programming, Introduction to Multiprogramming, System Bus Structure, Multiprocessor configurations, Coprocessor, Closely coupled and loosely Coupled configurations, Introduction to advanced processors.

I/O Interfacing: Memory Interfacing and I/O interfacing, Parallel communication interface, Serial communication interface, D/A and A/D Interface, Timer, Keyboard /display controller, Interrupt controller, DMA controller, Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Microcontroller: Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

Interfacing Microcontroller: Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation.

Books Recommended:
   (i) Liu, Y., & Gibson, G. (1986). Microcomputer systems: The 8086/8088 family: Architecture, programming, and design (2nd ed.). Englewood Cliffs, N.J.: Prentice-Hall.
   (ii) Gaonkar, R. (2002). Microprocessor architecture, programming, and applications with the 8085 (5th ed.). Upper Saddle River, NJ: Prentice Hall
   (iii) Rafiquzzaman, M. (1995). Microprocessors and microcomputer-based system design (2nd ed.). Boca Raton, Fla.: CRC Press.
   (iv) Mazidi, M., & McKinlay, R. (2008). The 8051 microcontroller and embedded systems: Using Assembly and C (2nd ed.). Delhi.: Pearson/Prentice Hall :.
   (v) Ganguly, A., & Ganguly, A. (2012). Microprocessors and microcontrollers 8085, 8086 and 8051. Oxford: Alpha Science.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P3	**Microprocessors and Assembly Language Lab**	**0.75**

Experiments	Topics
01	Simple programming exercises on 8085 (Like 8-bit multiplication, and division).
02	Code conversion, decimal arithmetic and Matrix operations.
03	Floating point operations, string manipulations, sorting and searching.
04	Simple programming with 8086 with a basic system calls for input/output (Arithmetic operations).
05	String manipulation - search, fixed and replace, copy operations, sorting and searching.
06	Shifting(Left Shift, Right Shift), Stack & Queue Implementation
07	File manipulations with system calls.
08	Interfacing with 8085/8086 – 8255 and 8253.
09	Interfacing with 8085/8086 – 8279, 8251, 8255
10	Microprocessor-based system development.
11	Application development using Microcontroller.

COURSE CODE	COURSE TITLE	CREDIT
CSE2234	**Information System Analysis and Design**	**3.0**

Introduction: Introduction to information systems, general design consideration of information systems.

Overview: System concepts and the information systems environment, information needs, the concepts of MIS, the system development life cycle, and the role of the systems analysis.

Systems Analysis: Systems planning and the initial investigation, information gathering, the tools of structured analysis, feasibility study, and cost-benefit analysis.

Systems Design: The process and stages of systems design, input/output and forms design, file organization and database design.

System Implementation: system testing and quality assurance, implementation and software maintenance, hardware/software selection, project scheduling and software, Security, disaster/recovery, and ethics in system development.

Case studies of various information systems such as Library management systems, inventory systems, voter identity management systems, payroll systems, etc.

Books Recommended:
  (i) Weinberg, G. (1988). Rethinking systems analysis & design. New York, NY: Dorset House Pub.
  (ii) Dennis, A., & Wixom, B. (2012). System analysis and design (5th ed.). Hoboken, NJ: John Wiley.
  (iii) Kendall, K., & Kendall, J. (2014). Systems analysis and design (9th ed.). Upper Saddle River, NJ: Pearson.
  (iv) Silver, G., & Silver, M. (1989). Systems analysis and design. Reading, Mass.: Addison-Wesley Pub.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P5	**Information System Analysis and Design Lab**	**0.75**

Experiments	Topics
01	Discuss and Assign a Project Name for the overall study; Identify the problem & define its scope; Perform Analysis (Feasibility, Requirement), Proposed models for the development.
02	Define the functioning of the project which you want to achieve by the completion of a project; Perform analysis on the functions whether it is achievable or not.
03	Plan the overall sequence to perform all the tasks and time limit of each module; Finalize the development model; Prepare the Gantt chart for overall development.
04	Discuss the tool to draw different types of diagrams throughout the analysis & design; Create DFD, E-R diagram, Flowchart, Decision tree, and decision table for Project.
05	Plan for design, Structured Design, IPO chart, Input/output Form design, Navigation of forms and flow of the system; Describe UML diagrams, Draw all as per the system.
06	Prepare the SRS for the overall project.
07	Modeling your System using Object; Different testing techniques and how and which is applicable to system.
08	Quality Assurance and maintenance of the system. How to reduce the cost and time of maintenance.

COURSE CODE	COURSE TITLE	CREDIT
CSE2236	**Computer Algorithms**	**3.0**

Mathematical tools: Review of mathematical background, concepts of algorithm design, complexity, asymptotic notation, induction, and randomization, Fibonacci numbers, Euclidean gcd algorithms, Universal hashing.

Divide and conquer: Fast integer multiplication; recurrences; the master theorem; mergesort; randomized median and selection algorithms; quick sort; fast matrix multiplication.

Sorting: Lower bounds for comparison-based sorting; bin sort and radix sort.

Dynamic programming: Paradigm of SPs in DAGs; longest increasing subsequence; approximate string matching; integer and (0,1) knapsack problems; chain matrix multiplication; single-pair reliable SPs, all-pairs SPs; independent sets.

Graph search: Graph classes and representations; depth first search in undirected and directed graphs; topological search; strongly connected components. Breadth first search and layered DAGs.

Shortest Paths (SPs) in digraphs: Single-source SPs for nonnegative edge weights; priority queues and Dijkstra; SPs in DAGs; single-source SPs for general edge weights. Maximum adjacency search.

Greedy algorithms: Spanning trees and cuts, analysis of union-find and path compression; MST algorithms; the randomized algorithm for global minimum cuts; approximate set cover.

Network flows: Max flow min cut theorem and integrality; fast algorithms; disjoint (s,t)- dipaths; maximum bipartite matching & minimum vertex cover. Global minimum cuts.

NP-Completeness: Matching; Introduction to NP-Complete; Search/Decision; SAT; Independent_Set; 3VC; Exact Cover; Multi Set; Subset Sum & Partition; Hamiltonian Circuit.

Books Recommended:

(i) Cormen, T. (2009). Introduction to algorithms (3rd ed.). Cambridge, Mass.: MIT Press.

(ii) Dasgupta, S., & Papadimitriou, C. (2008). Algorithms. Boston: McGraw-Hill Higher Education.

(iii) Baase, S., & Gelder, A. (2000). Computer algorithms: Introduction to design and analysis. (3rd ed.). Reading, Mass.: Addison-Wesley Longman.

(iv) Horowitz, E., Sahni, S., & Rajasekaran, S. (2008). Fundamentals of Computer Algorithms (2nd ed.). Universities Press.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P7	**Computer Algorithms Lab**	**1.5**

Experiments	Topics
01	**Sorting Algorithms:** To Analyze the time complexity of Insertion sort, Selection sort, Bubble sort, Bucket sort, and Heap sort.
02	**Dynamic Programming:** To Implement the Largest Common Subsequence, Optimal Binary Search Tree, and Matrix Chain Multiplication.
03	**Divide and Conquer Technique:** To Implement Strassen's matrix multiplication Algorithm, Quick sort, Merge sort.
04	**Greedy Algorithms:** To implement Knapsack Problem, Activity Selection Problem.
05	**Graphs:** To implement Dijkstra's Algorithm, Warshall's Algorithm, Bellman Ford's, Depth First Search Algorithm, Breadth First Search Algorithm.
06	**String Matching Algorithms:** To implement Naïve String Matching Algorithm, Rabin Karp String Matching Algorithm.
07	**Spanning Trees:** Prim's Algorithm, Kruskal's Algorithm.

COURSE CODE	COURSE TITLE	CREDIT
CSE2238	**Database Management System**	**3.0**

Introduction To Database Systems: Data - Database Applications - Evolution of DB & DBMS - Need for data management – Data models & Database Architecture - Professions in DBMS - Key issues and challenges in Database Systems

ER and Relational Models: ER Diagrams - Relational Model - ER to Relational Mapping - Constraints - Keys - Dependencies - Relational Algebra - Normalization - First, Second, Third & Fourth Normal Forms - BCNF – Join Dependencies

Data Definition and Querying: Basic DDL - Introduction to SQL - Data Constraints - Triggers - Database Security – Advanced SQL - Embedded & Dynamic SQL - Views

Transactions and Concurrency: Introduction to Transactions - Transaction Systems - ACID Properties - System & Media Recovery - Two-Phase Commit

Protocol - Recovery with SQL - Need for Concurrency Locking Protocols - Deadlocks & Managing Deadlocks - SQL Support for Concurrency

Advanced Topics in Databases: Indexing & Hashing Techniques - Query Processing & Optimization - Sorting & Joins – Database tuning - Introduction to Special Topics - Spatial & Temporal Databases - Data Mining & Warehousing - Data Visualization - Mobile Databases - OODB & XML Databases - Multimedia & Web Databases.

Books Recommended:

(i) Silberschatz, A., & Korth, H. (2011). Database system concepts (6th ed.). New York: McGraw-Hill.

(ii) Elmasri, R., & Navathe, S. (2011). Fundamentals of database systems (6th ed.). Boston: Addison-Wesley.

(iii) Molina, H., & Ullman, J. (2009). Database systems: The complete book (2nd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE22P9	**Database Management System Lab**	**1.5**

Experiments	Topics
01	Data Definition Commands.
02	Data Manipulation Commands.
03	DML Command to perform Nested and Join Queries.
04	Views – Creation and Manipulation.
05	Cursors and Triggers.
06	Procedural Extension Language.
07	Functions and Procedures.
08	Forms and Menu design using a Front End Tool.
09	Simple application development.
10	Report Generation.
11	Database connectivity techniques.
12	Design and implementation of a Database Application.

Third Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
MAT3131	**Statistics and Probability**	**3.0**

Probability: Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence.

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality.

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems.

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, and bivariate normal distribution.

Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables.

Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions.

Descriptive Statistics: Graphical representation, measures of locations and variability.

Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions.

Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications.

Books Recommended:
(i) Rohatgi, V., & Saleh, A. (2001). An introduction to probability and statistics (2nd ed.). New York: Wiley.

(ii) Mendenhall, W., & Beaver, R. (2013). Introduction to probability and statistics (14th ed., International ed.). Pacific Grove, Calif.: Brooks/Cole ;.

(iii) Milton, J., & Arnold, J. (2003). Introduction to probability and statistics: Principles and applications for engineering and the computing sciences (4th ed.). Boston: McGraw-Hill.

(iv) Larson, H. (1982). Introduction to probability theory and statistical inference (3rd ed.). New York: Wiley.

(v) Mosteller, F., & Rourke, R. (1970). Probability with statistical applications (2nd ed.). Reading, Mass: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE3122	**Theory of Computation**	2.0

Regular Languages: Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions - Regular Expression – FA and Regular Expressions – Pumping lemma for Regular languages - Equivalence and minimization of Finite Automata.

Context-Free Languages: Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Equivalence of Parse trees and derivation - Normal forms for CFG - Definition of the Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG – Pumping lemma for CFL.

Closure Properties and Turing Machines: Closure properties of Regular Sets: Complement and Intersection – Closure properties of CFL: Union, Concatenation, Kleene Closure, Intersection and Complement – Turing Machines – Language of a Turing machine – Turing machine as a computing device - Various techniques for construction of TMs – Equivalence of one tape and multi-tape Turing machines.

Undecidability: A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing Machine – Rice theorem for Recursive and Recursively enumerable languages – Post's Correspondence Problem.

Recent Trends & Applications: Matrix grammar – Programmed grammar – Random context grammar – Regular Control grammar – Lindenmayer systems – A Glance on DNA computing and Membrane computing.

Books Recommended:

(i) Hopcroft, J., & Motwani, R. (2007). Introduction to automata theory, languages, and computation (3rd ed.). Boston: Pearson/Addison Wesley.

(ii) Lewis, H., & Papadimitriou, C. (1998). Elements of the theory of computation (2nd ed.). Upper Saddle River, N.J.: Prentice-Hall.

(iii) Martin, J. (2011). Introduction to languages and the theory of computation (4th ed.). New York, NY: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE3133	**Data and Telecommunications**	**3.0**

Introduction to data communication: Components, data representation, data flow and basic model, data representation, Serial & Parallel transmission, Modes of data transmission, Encoding: Unipolar, Polar, Bipolar line & block codes, Data compression Frequency dependent codes, Run-length encoding, Relative encoding, LZ Compression Image and multimedia compression, Review of analogue & digital transmission methods, Nyquist Theorem.

Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM, North American digital multiplexing hierarchy, European TDM, Spread spectrum: Frequency Hopping & Direct Sequence spread spectrum, Terminal handling & polling, Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching, Soft switch Architecture with their comparative study, X.25, ISDN.

Physical Layer: Introduction, Interface, Standards, EIA-232-D, RJ-45, RJ-11, BNC connector & EIA-449 Digital Interface: Connection, specifications & configuration, X.21 Modem: Types, features, signal constellation, block schematic, limited distance, dial-up, baseband, line driver, Group Band and Null modems etc., ITU-T V-series modem standards Connecting Devices: Active and Passive Hubs, Repeaters, Bridges, Two & Three layer switches & Gateway. Study of various types of topology and their comparative study, introduction to queuing theory.

Transmission Media: Transmission line characteristics, distortions, Crosstalk, Guided Media: Twisted Pair, Baseband & Broadband Coaxial, Optical Fiber: Physics and velocity of propagation of light, Advantages & Disadvantages, Block diagram, Nodes And classification, Comparison, losses, light source and detectors, Construction, Unguided media: Electromagnetic polarization, Rays and waves front, electromagnetic spectrum and radiation, spherical wavefront and inverse square law, wave attenuation and absorption, optical properties of Radio waves, Terrestrial Propagation of electromagnetic waves, skip distance, free - space path loss, Radio waves, Microwave, Infrared & Satellite

Communication system. Telephone Network: Components, LATAs, signalling and Services, Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL, Cable TV network for data transfer.

Transmission Errors: Content Error, flow integrity error, methods of error control, Error detection, Error correction, Bit error rate, Error detection methods: Parity checking, Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum.

Telecommunication: Introduction to mobile communication, Cellular concepts, Wimax, 2G, 3G, 4G.

Books Recommended:

(i) Forouzan, B. (2013). Data communications and networking (Fifth ed.). New York: McGraw-Hill.
(ii) Tomasi, W. (2005). Introduction to data communications and networking. Upper Saddle River, N.J.: Pearson Prentice Hall.
(iii) Gupta, P. (1998). Data communication. New Delhi: Prentice-Hall of India.
(iv) Pahuja, S. (2005). The complete reference data communications and computer networks (2nd ed.). Delhi: Standard Distributors.
(v) Tanenbaum, A., & Wetherall, D. (2011). Computer networks (5th ed.). Boston: Pearson Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE3134	Operating System	3.0

Operating Systems Overview: Computer System Overview - Basic Elements, Instruction Execution, Interrupts Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview - objectives and functions, Evolution of Operating System - Computer System Organization - Operating System Structure and Operations - System Calls, System Programs, OS Generation and System Boot.

Process Management: Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads - Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

Storage Management: Main Memory - Contiguous Memory Allocation, Segmentation, Paging, 32 and 64-bit architecture Examples; Virtual Memory - Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

I/O Systems: Mass Storage Structure - Overview, Disk Scheduling and Management; File System Storage - File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation - File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

Case Study: Linux System - Basic Concepts; System Administration - Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting up Local Network Services; Virtualization - Basic Concepts, Setting upXen, VMware on Linux Host and Adding Guest OS.

Books Recommended:

(i) Silberschatz, A., & Galvin, P. (2009). Operating system concepts (8th ed.). Hoboken, NJ: J. Wiley & Sons.
(ii) Stallings, W. (2014). Operating systems: Internals and design principles (Eighth ed.). Prentice Hall.
(iii) Tanenbaum, A. (2014). Modern operating systems (4.th ed.). Boston: Pearson.
(iv) Crowley, C. (1997). Operating systems: A design-oriented approach. Chicago: Irwin.
(v) Dhamdhere, D. (2009). Operating systems: A concept-based approach. New York, N.Y.: McGraw-Hill.

COURSE CODE	COURSE TITLE	CREDIT
CSE31P5	**Operating System Lab**	**1.5**

Experiments	Topics
01	Basics of Linux commands.
02	Shell Programming.
03	Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
04	Implement all file allocation strategies a) Sequential b) Indexed c) Linked
05	Implement Semaphores
06	Implement all File Organization Techniques a) Single level directory b) Two level c) Hierarchical

	d) DAG
07	Implement Bankers Algorithm for Dead Lock Avoidance
08	Implement an Algorithm for Dead Lock Detection

09	Implement all page replacement algorithms
	    a) FIFO
	    b) LRU
	    c) LFU
	    d) Optimal Algorithm

10	Implement Shared memory and IPC
11	Implement the Paging Technique of memory management.
12	Implement Threading & Synchronization Applications
13	**Disk Scheduling Algorithms:** First Come-First Serve (FCFS), Shortest Seek Time First (SSTF), Elevator (SCAN), Circular SCAN (C-SCAN), LOOK, C-LOOK.

COURSE CODE	COURSE TITLE	CREDIT
CSE3136	**Advanced Database Management System**	**3.0**

Working with large datasets with million records - use advanced queries (joins, unions), views, triggers, procedures, and aggregate functions. Storage - disk storage, basic file structure and hashing, Indexes, B-Trees and B+-Trees **(Review this session only, because it is an important issue);** Query Optimization techniques. - Query Processing (translation of SQL Queries), cost estimation; Object Oriented Databases-Need for Complex Data Types, Persistence of Objects, Object Identity and pointers, Storage and access of persistent objects, Persistent C++ system, ODMG C++ object definition language.Database Security - access control, SQL injection attack, flow control, encryption, privacy issues and preservation

Database Backup and recovery - recovery concept, recovery based on immediate update, shadow paging, database backup, ARIES recovery algorithmDistributed Databases - distributed database architecture, query processing and optimization in distributed environment, transaction management system in in distributed environment, concurrency control in distributed environmentNo-SQL databases - introduction to no-SQL databases, mongodbConcurrency management - two-phase locking, timestamp ordering, multi-version concurrency control and so on.

Parallel Databases-Introduction, I/O parallelism, Interquery Parallelism, Intraquery parallelism, Interoperational parallelism.Database scaling - horizontal and vertical scaling.

Books Recommended:

    (i)   Date, C. (2004). An introduction to database systems (8th ed.). Boston: Pearson/Addison Wesley.

    (ii) Dawes, C., & Thomas, B. (2002). OCA/OCP introduction to Oracle9i SQL study guide. San Francisco, Calif.: Sybex.

    (iii) Thomas, B. (2009). OCP: Oracle Database 11g Administrator Certified Professional Certification Kit. (1.st ed.). Indianapolis, Ind.: Wiley.

    (iv) Alapati, S., & Kuhn, D. (2011). Oracle database 11g performance tuning recipes a problem-solution approach. New York: Apress.

COURSE CODE	COURSE TITLE	CREDIT
CSE31P7	Advanced Database Management System Lab	1.5

Experiments	Topics
01	Data Definition Commands and Data Manipulation Commands.
02	DML Command to perform Nested and Join Queries.
03	Views, Triggers and procedures.
04	Database security - creating users, granting and revoking privileges to/from users, controlling user access using views.
05	Database security - demonstration of SQL injection attack and its prevention
06	Database backup and recovery
07	Database connectivity techniques.
08	Design and implementation of a Database Application.
09	Introduction to NoSQL database with MongoDB
10	More on NoSQL databases with MongoDB
11	Replication technique for scaling
12	Database partitioning methods

COURSE CODE	COURSE TITLE	CREDIT
CSE31P8	**Object Oriented Programming – II Lab**	**1.5**

Experiments	Topics
01	Introduction to .NET frameworks
02	Understanding C# Language Fundamentals; Writing a Savings Account Calculator
03	Creating Objects in C#; Creating the Bank Account Objects
04	Implementing Object-Oriented Programming Techniques in C#; Creating Classes in C#
05	Programming with C#; Using Arrays; Using Indexers and Interfaces; Using Delegates and Events
06	Building .NET-based Applications with C#
07	Using ADO.NET to Access Data; Creating a Data Access Application with ADO.NET; Creating a Windows Application That Uses ADO.NET
08	Creating Windows-based Applications; Adding Common Dialog Boxes to an Application; Creating and Using Custom Dialog Boxes; Creating a Status Bar
09	Using XML Web Services in a C# Application
10	Creating a Web Application with Web Forms; Developing an ASP.NET Web Application; Completing the User Authentication Validation Code; Completing the Code for the Master.aspx Form; Testing the Application
11	Application Settings and Deployment; Adding a Setup Project to an Existing Application; Installing and Testing the Setup Application; Working with Application Settings; Adding the UserPreferences Class; Adding User Preferences to the Form Load Event; Adding User Preferences to the loadItem_Click Event Declaring an Instance of the UserPreferences Class in the Options Form; Setting the Checkbox Controls to the Values Contained in the Registry; Save the Checkbox Controls Values to the Registry; Testing the Zoo Information Application

COURSE CODE	COURSE TITLE	CREDIT
CSE31P9	**Numerical Analysis Lab**	**1.5**

Experiments	Topics
01	To Find the Roots of Non-Linear Equation Using Bisection Method.
02	To Find the Roots of Non-Linear Equation Using Newton's Method.
03	Curve Fitting by Least – Square Approximations, Regression method.
04	To Solve the System of Linear Equations Using Gauss - Elimination Method, Gauss Pivot Elimination Method.
05	To Solve the System of Linear Equations Using Gauss - Seidel Iteration Method
06	To Solve the System of Linear Equations Using Gauss - Jorden Method.
07	To Integrate Numerically Using Trapezoidal Rule.
08	To Integrate Numerically Using Simpson's Rules.
09	To Find the Largest Eigen Value of a Matrix By Power - Method.
10	To Find Numerical Solutions of Ordinary Differential Equations by Euler's Method.
11	To Find Numerical Solutions of Ordinary Differential Equations by Runge-Kutta Method.
12	To Find the Numerical Solution of the Laplace Equation
13	To Find the Numerical Solution of the Wave Equation
14	To Find the Numerical Solution of the Heat Equation.

Third Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE3221	**E-commerce**	**2.0**

Introduction To E-Commerce: Meaning and concept of E-Commerce; History of E-Commerce; Traditional Commerce and E-Commerce; Different types of E-Commerce – B2B, B2C, C2C, B2E, G2C; Need and Role of E-Commerce; Advantage and Disadvantage of E-Commerce – organization, Consumer, Society; E-Business and E-Commerce; Value Chain in E-Business.

E-Commerce Technologies: Internet & WWW; Internet Protocols – OSI Model, TCP/IP, TCP, UDP, IP, DNS, FTP, SLIP, PPP; Multimedia technology – ISDN, ATM, Cell relay, desktop Video Conferencing; Information Publishing Technology - HTML, URL, HTTP, HTML FORM, HTTPD, CGI SERVICES, Web Server and client; Advance Technologies – Mobile Agents, WAP, XML, web 2.0, REST web services, Web Mashup.

E-Commerce Strategies: Consumer Oriented – strategies for marketing, sales & promotion, e-CRM, and order delivery Cycle; Business Oriented - strategies for purchasing & support activities (SCM), Strategies for Web Auction, Virtual Communities, Web Portal.

Electronic Payment System: Introduction to payment system; Online Payment System – prepaid e-payment service, postpaid e-payment system; SET protocol; Operational, Credit & legal risk of e-payment system.

Electronic Data Interchange: Meaning; EDI and Paperless trading; EDI architecture; EDI standards; VAN; Cost of EDI Infrastructure; Internet-based EDI; FTP- based messaging.

Electronic Data Interchange: Meaning; EDI and Paperless trading; EDI architecture; EDI standards; VAN; Cost of EDI Infrastructure; Internet-based EDI; FTP- based messaging.

Security & Legal Issues: Computer security classification; E-Commerce threats; Security of Clients and sever; Cyberlaw introduction; Copyright and Intellectual Property concept relating to e-commerce.

Books Recommended:
- (i) Bhasker, B. (2013). Electronic Commerce: Framework, Technologies, and Applications (4th ed.). Tata McGraw Hill Education Private Limited.
- (ii) Bajaj, K., & Nag, D. (1999). E-commerce: The cutting edge of business. New Delhi: Tata McGraw-Hill.
- (iii) Kalakota, R., & Whinston, A. (1996). Frontiers of electronic commerce. Reading, Mass.: Addison-Wesley Pub.

(iv) Whitley, D. (2010). E-commerce. New Delhi: Tata Mcgraw Hill Education Private.

(v) Chaffey, D. (2011). E-business & e-commerce management: Strategy, implementation and practice (5th ed.). Harlow, England: Pearson/Financial Times Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE3232	**Human-Computer Interaction**	3.0

Design Process: Humans, Information process, Computer, Information Process, Differences and Similarities between them, Need for Interaction, Models, Ergonomics, Style, Context, Paradigms, Designing of Interactive systems, Usability, Paradigm shift, Interaction design basics, Design Process, Scenarios, Users need, Complexity of design.

Design and Evaluation of Interactive Systems: Software Process, Usability engineering, Issue-based Information systems, Iterative design practices, Design rules, maximum usability, Principles, Standards and guidelines, design patterns, Programming Tools, Windowing systems, Interaction tool kit, User Interface management system, Evaluation techniques, evaluation design, Evaluating implementations, Observational Methods.

Models: Universal design principles, Multimodal systems, User Support, Presentation and Implementation Issues, types, requirements, approaches, Cognitive model, Hierarchical model, Linguistic model, physical and device models, Socio-technical models, Communication and Collaboration models, Task models, Task analysis and design.

Experimental Design and Statistical Analysis of HCI: Basic Design structure, Single independent variable, multiple independent variables, factorial design, split-plot design, random errors, experimental procedure, Statistical analysis, T-tests, Analysis of Variance test, Regression, Chi-Square test, Survey, Probabilistic sampling, Non-probabilistic sampling, developing survey questions.

Theories: Dialogue notations and design, Dialogue need, dialogue design notations, Graphical, Textual, representing dialogue, formal descriptions, Dialogue analysis, System models, Interaction models, relationship with dialogue, Formalisms, Formal notations, Interstitial behaviour, Virtual reality, Modeling rich interaction, Status Event analysis, Properties, Rich contexts, Sensor-based systems, Groupware, Applications, Ubiquitous computing, Virtual reality.

Books Recommended:

(i) Dix, A. (2004). Human-computer interaction (3rd ed.). Harlow, England: Pearson/Prentice-Hall.

(ii) Lazar, J., & Feng, J. (2010). Research methods in human-computer interaction. Chichester, West Sussex, U.K.: Wiley.

(iii) Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: Strategies for effective human-computer interaction (5th ed.). Boston: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE3233	Computer Networks	3.0

Computer Network: Definitions, goals, components, structure, Architecture, Classifications & types, Growth, Complexity and applications etc. Layered Architecture: Protocol hierarchy, Connection Oriented & Connectionless Services, Service primitive Design issues & their functionality, ISO-OSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Network standardization, Examples of Networks: Telecommunication Networks, Corporate Networks, Connection-oriented Networks i.e., X.25, Frame relay & ATM, Wireless LAN 802.11, Internet, Intranet, Extranet, SNA & DNA etc.

Data Link Layer: Need, Services Provided, Framing & its Methods, Flow Control, Error Control. DLL Protocol: Elementary & Sliding Window. Piggybacking & Pipelining. Protocol verification: Finite State Machine Models & Petri net models. Example in Data Link Layers: HDLC & Internet. Comparison of BISYNC and HDLC Features. Bridges and layer-2 switches.

MAC Sublayer: Static & Dynamic channel allocation, Media access control for LAN & WAN. Classification of MAC Sub layer protocol, Study of various collision, Collision free & limited contention protocols i.e., ALOHA: pure, slotted, CSMA, CSMA/CD, CSMA/CA, Bit Map, Binary count down, BRAP, MLMA, Adaptive tree walk & urn protocol etc. IEEE 802 standards for LAN & MAN & their comparison. Ethernet: Cabling, Binary exponentials algorithms, performance fast Ethernet, Gigabit Ethernet, FDDI. Wireless LANs, Broadband Wireless, Bluetooth: Architecture, Application & Layering.

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least Cost Routing algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for mobile hosts, Routing in Ad Hoc Networks Routing Strategies, Congestion Control Algorithms: General Principles of Congestion control, Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram subnets. IP protocol, IP Addresses, Comparative study of IPv4 & IPv6, Mobile IP.

Processes to Processes Delivery: Transmission Control Protocol (TCP) – User Datagram Protocol, Data Traffic, Congestion Control and Quality of Service,

Techniques to improve QOS, Integrated Services, and Differentiated Services. Network Security: Cryptography, Message Security, Digital Signature, User Authentication, Key Management, Security Protocols in Internet, DNS, SMTP, FTP, HTTP, WWW, Virtual Terminal Protocol, VoIP: Basic IP Telephone System, H.323 Characteristic & Layering, SIP Characteristics, Method & Sessions.

Books Recommended:

(i) Tanenbaum, A., & Wetherall, D. (2011). Computer networks (5th ed.). Boston: Pearson Prentice Hall.
(ii) Halsall, F. (2005). Computer networking and the Internet (5th ed.). Harlow: Addison-Wesley.
(iii) Forouzan, B., & Fegan, S. (2007). Data communications and networking (4th ed.). New York: McGraw-Hill Higher Education.
(iv) Gupta, P. (2006). Data communications and computer networks. New Delhi: Prentice-Hall of India.
(v) Bertsekas, D., & Gallager, R. (1992). Data networks (2nd ed.). Englewood Cliffs, N.J.: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P4	**Computer Networks Lab**	**1.5**

Experiments	Topics
01	Study of Wiring Technology
02	Install and Configure Network Cards
03	Socket Programming
04	Implement Routing Protocols in C and Install and Configure Server
05	Install and Configure DHCP & DNS
06	Install and Configure Domain Controller
07	Install and Configure Web Server and Proxy Server
08	Install and Configure Mail Server
09	Install and Configure Samba
10	Testing and Troubleshoot Internet
11	Local Area Networks Design.
12	Wide Area Network Design
13	Configuring VLAN using Packet tracer
14	ATN & ACL
15	Router configuration using Packet tracer

COURSE CODE	COURSE TITLE	CREDIT
CSE3235	**Computer Peripherals and Interfacing**	3.0

Video Display: The basic principle of working of video monitors (CRT, LCD, LED), video display adapters, video modes, Video display EGA/VGA/SVGA/PCI adapters and their architecture, Overview of raster scan, vector graphic, their main difference and relative advantages, Concept of reduction and bandwidth of monitors refreshing of the screen.

Hardware Organization of PCs: Types of the motherboard and their details (Form Factor, Chipset), types of processors (INTEL, AMD) and their compatibility with motherboards, serial and parallel ports, PS/2, USB Ports, Interconnection between units, connectors and cables.

Storage Devices: Types of Hard Disk Drives - EIDE, SATA, SCSI, SAS External Hard Disk. Constructional features and working of hard disk drive, optical (CD, DVD and Blue Ray) disk drive and Flash Drive, Logical structure of Hard Disk and its organization, boot record.

Input Devices: Detailed working principle and troubleshooting of various input devices such as keyboard, mouse, scanner, Basic principle of touch screen, light pen, digitizers, and Drivers for various input devices and their role.

Output Devices: Overview of printer and its classification, impact and non-impact printer, principle and working of desk Jet, dot matrix, line Printer and laser printers(Monochrome and Color), plotter (Piezoelectric and Thermal), and modems. Software drivers for various output devices and their role.

Power Supplies: Explain the working of SMPS used in computers, On-Line/Off-Line/Line-Interactive/uninterrupted power supplies (UPS), basic principles of working their importance and maintenance.

The Basic Input/Output System: What is BIOS? Function of BIOS, software interrupts, testing and initialization, configuring the system.

Other Technologies: Mobile, digital camera, web camera, smart card, ATMs, CDMA etc., Blue Tooth, infrared, Wi-Fi, WiMax. Some aspects of cost performance analysis while procuring the computer.

Books Recommended:
(i) Govindarajalu, B. (2002). IBM PC and clones: Hardware, troubleshooting and maintenance (2nd ed.). New Delhi: Tata McGraw-Hill Pub.
(ii) Gupta, G. (n.d.). Computer Peripheral & Interfacing. Jalandhar: Eagle Prakashan.
(iii) Hall, D. (1992). Microprocessors and interfacing: Programming and hardware (2nd ed.). Lake Forest, Ill.: Glencoe.

(iv) Snehi, J. (2006). Computer peripherals and interfacing. S.l.: Laxmi Publications.

(v) Wilkinson, B., & Horrocks, D. (1980). Computer peripherals. London: Hodder and Stoughton.

(vi) Cook, B., & White, N. (1995). Computer peripherals (3rd ed.). London: E. Arnold.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P6	**Computer Peripherals and Interfacing Lab**	0.75

Experiments	Topics
01	Demonstration of Trainer Board
02	Reading data from Trainer Board to Computer.
03	Write data from a computer to Trainer Board
04	Design and implementation of an IC tester
05	Design and implementation of a Transistor tester
06	Design and implementation of a Water Level controller
07	Serial data transfer through ports between computers
08	Parallel data transfer through ports between computers
09	Audio data reading
10	Audio data Writing
11	Control of digital voltage
12	Traffic control

COURSE CODE	COURSE TITLE	CREDIT
CSE3237	**Software Engineering**	3.0

Software Process Models: The Evolving role of Software, Software, The Changing Nature of Software, Legacy software, A generic view of the process, A layered Technology, A Process Framework, The Capability Maturity Model Integration (CMMI), Process Assessment, Personal and Team Process Models, Product and Process, Process Models, The Waterfall Model, Incremental Process Models, Incremental Model, The RAD Model, Evolutionary Process Models, Prototyping, The Spiral Model, The Concurrent Development Model, Specialized Process Models, the Unified Process.

Requirement Engineering: Software Engineering Practice, Communication Practice, Planning Practice, modelling practice, Construction Practice, Deployment. Requirements Engineering, Requirements Engineering tasks,

Initiating the Requirements Engineering Process, Eliciting Requirements, Developing Use Cases, Building the Analysis Models, Elements of the Analysis Model, Analysis pattern, Negotiating Requirements, and Validating Requirements.

Analysis Modeling: Requirements Analysis, Analysis Modeling approaches, data modelling concepts, Object-oriented Analysis, Scenario-based modelling, Flow-oriented Modeling, Class-based modelling, creating a behaviour model.

Design & Testing: Design Engineering, Design process, Design Quality, Design model, User interface Design, Testing strategies, Testing Tactics, Strategies Issues for conventional and object-oriented software, validation testing, system testing, Art of debugging, and Project management.

Quality & Maintenance: Software evolution, Verification and Validation, Critical Systems Validation, Metrics for Process, Project and Product-Quality Management, Process Improvement, Risk Management Configuration Management, and Software Cost Estimation.

Books Recommended:
   (i) Pressman, R., & Maxim, B. (2014). Software engineering: A practitioner's approach (Eighth ed.). McGraw-Hill Science/Engineering/Math.
   (ii) Sommerville, I. (2011). Software engineering (9th ed.). Boston: Pearson.
   (iii) Schach, S. (2008). Object-oriented software engineering. Boston, Mass.: McGraw-Hill.
   (iv) Pfleeger, S., & Atlee, J. (2010). Software engineering: Theory and practice (4th ed.). Upper Saddle River [N.J.: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P8	**Software Development Project**	**1.5**

Develop a software package in any application relevant to any area of study of your curriculum by applying the Software Engineering Practices generally done by software industries, which are
   1. Identification of Use cases for each application system and SRS preparation.
   2. Identification of reusable Components/Frameworks from open source and customizing them for each application.
   3. Coding/Customizing/Wrapping for components/subsystems.
   4. Testing – Scenario testing and test case preparation for each component/subsystem
   5. Integration of subsystems and Testing
   6. Simulation of datasets and load testing to analyze the performance of the system.

COURSE CODE	COURSE TITLE	CREDIT
CSE32P9	**Technical Writing and Seminar**	**1.5**

The goal of this course is to train the students to critically evaluate a well-defined set of research subjects and to summarize the findings in a paper of scientific quality. The paper will be evaluated based on the ability to understand a topic, communicate it and identify issues. Results from this term paper will be presented to fellow students and a committee of faculty members.

1) Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2) Every student must write a short review of the topic and present it to fellow students and faculty every week.
3) The faculty should evaluate the short review and award marks concerning the following.
    a. Has the student analyzed- not merely quoted-the most significant portions of the primary source employed?
    b. Has the student offered original and convincing insights?
    c. Plagiarism to be checked.
4) Every student should re-submit and present the review article including issues/comments/conclusions which had arisen during the previous discussion.
5) Every student should submit a final paper as per project specifications along with all short review reports and corresponding evaluation comments.
6) Every student should appear for a final external review exam to defend themselves.

Interpretation of Data and Paper Writing: Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Use of Encyclopedias, Research Guides and Handbooks: Academic Databases for Computer Science Discipline.

Use of tools/techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

Fourth Year First Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE4121	**Professional Ethics and Cyber Law**	**2.0**

Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Evolution of Law in Cyberspace: The Online Landscape: Technological, Social and Legal Issues, Harmonization of Laws and the Issue of Jurisdiction Over the Internet, The Internet in the Context of International Commerce, Electronic Signature Legislation-a historical respective, An Overview of Specific Aspects, SEBI Guidelines, The UNCITRAL Model Law and Electronic Equivalents to Traditional Bills of Lading.

Security Concerns: The legal framework, Confidential Information, Protection of Confidential Information, Nature of confidential information, Confidence implied in a contract, Confidence implied by circumstances, Identification of confidential information, Essential requirements of breach of confidence, Exceptions to breach of confidence, Remedies for breach of confidence, Employee Privacy Rights, Employer Protection, Internet Banking in India: Analyzing Legal Issues, Negligent Misstatements.

Intellectual Property in Cyberspace: Intellectual Property on The Internet, Squatting in Cyberspace: A Web of Deception, WIPO Cases Involving Complainants from India, Intellectual Property (Trade Marks), Domain Names: ICANN and New Remedies Against Cybersquatting, Domain names, copyright intellectual Property and the Internet: A case study of the Indian approach to intellectual property and e-commerce, The CSS Technology License, DVD Audio Disc Copy Protection, Systems-on-a-Chip: Intellectual Property and Licensing Issues.

Protection of Personal Data and Privacy: Introduction, Personal Data, Data Subject, Data Processing: Definition and Grounds, Purpose Limitation, Legitimate Purposes, Data Controllers And Data Processors, Establishment, Data - Access and Information, Anonymous and Pseudonymous Data, Freedom of Expression, Free Flow of Data within the Eu, Data Transfer, Data Minimization.

Books Recommended:

(i) Martin, M., & Schinzinger, R. (2005). Ethics in engineering (4th ed.). Boston: McGraw-Hill.

(ii) Singh, Y. (2007). Cyber laws: A guide to cyber laws, information technology, computer software, intellectual property rights, e-commerce, taxation, privacy, etc., along with policies, guidelines, and agreements (3rd ed.). New Delhi: Universal Law Pub.

(iii) Sharma, V. (2002). Handbook of Cyber Laws: For Every Netizen. Macmillan India.

(iv) Craig, B. (2013). Cyberlaw: The law of the Internet and information technology. Upper Saddle River, N.J.: Pearson Education/Prentice Hall.

(v) Fleddermann, C. (2012). Engineering ethics (4th ed.). Upper Saddle River: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE4132	**Principles of Distributed Systems**	**3.0**

Introduction: Introduction to Distributed systems - challenges - architectural models - fundamental models P2P systems - Introduction to interposes communications - external data representation and marshaling- client-server communication - group communication-multicast/pub-sub - Energy Efficient Computing - Cloud computing.

Distributed Objects and File System: Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - Java RMI case Study - Introduction to DFS - File service architecture – Google fie system - Introduction to Name Services- Name services and DNS - Directory and directory services-Cluster Computing - map-reduce/big table.

Distributed Operating System Support: The operating system layer – Protection - Process and threads - Communication and invocation - Operating system architecture - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks Global states - Distributed mutual exclusion - Overlay Networks - DHT.

Transaction And Concurrency Control-Distributed Transactions: Transactions – Nested transaction – Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery - Data- Intensive Computing and Map Reduce.

Fault Tolerance, Security and Replication: Overview of security techniques - Cryptographic algorithms – Digital signatures - Cryptography pragmatics –

Distributed Replication - CDNs and replication – Fault-tolerant services - Byzantine Fault Tolerance - Detecting and Correcting Local Faults - Logging and Crash Recovery – Highly available services – Transactions with replicated data.

Case study: Multiplayer online games, Social networking services, Large object CDN's (video/audio streaming systems)

Books Recommended:
 (i) Tanenbaum, A., & Steen, M. (2007). Distributed systems: Principles and paradigms (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.
 (ii) Coulouris, G. (2012). Distributed systems: Concepts and design (5th ed.). Boston: Addison-Wesley.
 (iii) Singhal, M., & Shivaratri, N. (1994). Advanced concepts in operating systems: Distributed, database, and multiprocessor operating systems. New York: McGraw-Hill.
 (iv) Birman, K. (2005). Reliable distributed systems technologies, Web services, and applications. New York: Springer.
 (v) Attiya, H., & Welch, J. (2004). Distributed computing fundamentals, simulations, and advanced topics (2nd ed.). Hoboken, NJ: Wiley.

COURSE CODE	COURSE TITLE	CREDIT
CSE4133	**Artificial Intelligence**	3.0

Introduction: What is intelligence? Foundations of artificial intelligence (AI), History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Informed Search Strategies: Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.

Reasoning: Representation, Inference, Propositional Logic, predicate logic (first-order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS.

Planning: Basic representation of plans, partial order planning, planning in the blocks world, hierarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints

Uncertainty: Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, and Decision theoretic expert systems.

Inductive Learning: decision trees, rule-based learning, current-best-hypothesis search, least commitment search, neural networks, reinforcement learning, genetic algorithms; Other learning methods neural networks, reinforcement learning, genetic algorithms.

Communication: Communication among agents, natural language processing, formal grammar, parsing, grammar.

Books Recommended:

(i) Russell, S., & Norvig, P. (2010). Artificial intelligence: A modern approach (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

(ii) Rich, E., & Knight, K. (2008). Artificial Intelligence (3rd ed.). New York: Tata McGraw-Hill.

(iii) Luger, G. (2009). Artificial intelligence: Structures and strategies for complex problem solving (6th ed.). Boston: Pearson Addison-Wesley.

(iv) Nilsson, N. (1998). Artificial Intelligence: A new synthesis. San Francisco, Calif.: Morgan Kaufmann.

COURSE CODE	COURSE TITLE	CREDIT
CSE 41P4	**Artificial Intelligence Lab**	**0.75**

Experiments	Topics
01	Implementing basic logic gates in Prolog.
02	Implementing human family relations using Prolog
03	Implementing monkey-banana problem using Prolog
04	Implement the logic for the selection process in an interview using Prolog
05	Using Dynamic Database using Prolog
06	Implement Fibonacci number and m^n value using Lisp.
07	Implementation of AND gate with Perceptions.
08	Implementation of NOR gate with Perceptions.
09	Implementation of XOR gate with Back Propagation Neural Network
10	Implementation of Genetic Algorithm.
11	Implementation of DFS and BFS

COURSE CODE	COURSE TITLE	CREDIT
CSE4135	**Web Engineering**	3.0

An Introduction to Web Engineering: Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage-related Characteristics, Development-related Characteristics, Evolution of web engineering.

Requirements Engineering for Web Applications: Introduction, Fundamentals, Where Do Requirements Come From? Requirements Engineering (RE) Activities, RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools.

Technologies for Web Applications: Client-side Technologies, ActiveX Controls, Document-specific Technologies, HTML- Hypertext Markup Language, DHTML, SMIL Synchronized Multimedia Integration Language, XML-eXtensible Markup Language, XSL-eXtensible Style sheet Language, Java Script, Server-side Technologies, Serve let, URI Handlers, Web Service, Middleware Technologies.

Web Application Architectures: Introduction, Fundamentals, What is Architecture? Developing Architectures Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N- Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, and Architectures for Multimedia Data.

Modelling Web Applications: Introduction, Fundamental, Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Relation to Content, Hypertext and Presentation Modeling.

Web Application Design: Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Interaction Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

Testing Web Applications: Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools.

Web Project Management: Understanding Scope, Refining Framework Activities, Building a WebE Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project.

Books Recommended:

  (i)   Kappel, G. (2006). Web engineering: The discipline of systematic development of web applications. Hoboken, NJ: John Wiley & Sons.
  (ii) Suh, W. (2005). Web engineering: Principles and techniques. Hershey, PA: Idea Group Pub.
  (iii) Pressman, R., & Lowe, D. (2009). Web engineering: A practitioner's approach. Boston: McGraw-Hill Higher Education.
  (iv) Thompson, G. (2008). Just enough Web Programming with XHTML, PHP, and MYSQL. Australia: Cengage Learning, Course Technology PTR.

COURSE CODE	COURSE TITLE	CREDIT
CSE41P6	**Web Engineering Lab**	**1.5**

Experiments	Topics
01	To Study Web servers and web Browsers
02	Create a web page purely in HTML code
03	Create a web page to show an application of CSS file
04	Study of JavaScript and applying javascript to validate form
05	Create a web page using HTML, javascript, CSS file
06	Create a web page to show an application of form controls
07	a) Write a code in ASP to format the text with HTML tags. b) Write a code to reverse the string. c) Write a code to check is user is connected or not
08	Create an XML document template to describe the result of a student in an examination.
09	Detail Learning about PHP
10	A mini project is desirable to be completed by a group of three that cover the following tools. a) HTML b) DHTML c) PHP d) XML e) Java Script/ CGI/ Pearl f) ASP

COURSE CODE	COURSE TITLE	CREDIT
CSE4137	**Computer Graphics and Multimedia System**	3.0

Computer Graphics Application: Introduction to Computer Graphics, Application of Computer Graphics.

Devices for Graphics Output: Monitor Basics, Picture Tube, Display Basics, Text Mode and Graphics Mode, Adapters and Displays, Monochrome Display Adapter (MDA), Color Graphics Adapter (CGA), Hercules Graphics Card, Enhanced Graphics Adapter, Professional Graphics Adapter, Digital vs Analog, Video Graphics Array, Super VGA, Refresh Cathode-Ray Tubes, Raster-Scan Displays, Random-Scan Displays.

Computer Display: Flat-Panel Displays, Raster Scan Systems, Random Scan Systems, Hard Copy Output Devices.

Graphics Input Devices: Keyboards, Mouse, Trackball and Space ball, Joysticks, Data Glove, Digitizers, Image Scanners, Touch Panels, Light Pens, Voice Systems, Input of Graphical Data, Logical Classification of Input Devices, Input Functions, Initial Values for Input Device Parameters, Interactive Picture Construction Techniques.

Matrices and Determinants: Matrices, Types of Matrices, Determinants, Matrix (Definition), Type of Matrices, Sub matrices of a Matrix: (Definition), Equality of Two Matrices: (Definition), Addition of Matrices, Scalar Multiplication, Multiplication of Two Matrices (Definition), Transpose of a Matrix (Definition), Symmetric and Skew-Symmetric Matrices, Adjoint and Inverse of a Matrix, Determinants, Properties of Determinants.

Vectors: Definition of a Vector, Vectors and Coordinate System, Algebra of Vectors Addition, Multiplication of a Vector by a Scalar, Components of a Vector, Direction and Magnitude of a Vector in Terms of its Components, Collinear and Coplanar Vectors, Some Applications to Geometry.

Raster Scan Graphics: Derivative of a Function, Digital Differential Analyzer, Bresenham's Algorithm, Integer Bresenham's Algorithm, General Bresenham's Algorithm, Circle Generation - Bresenham's Algorithm, Scan Conversion-Generation of the Display, Real-Time Scan Conversion, Run-Length Encoding, Cell Encoding, Frame Buffers, Addressing the Raster, Line Display, Character Display, Solid Area Scan Conversion, Polygon Filling, Scan-Converting Polygons, A Simple Ordered Edge List Algorithm, More Efficient Ordered Edge List Algorithms, The Edge Fill Algorithm, The Edge Flag Algorithm, Seed Fill Algorithms, A Simple Seed Fill Algorithm, A Scan Line Seed Fill Algorithm, Fundamentals of Antialiasing, Simple Area Antialiasing, The Convolution Integral And Antialiasing, Half toning.

Windows and Clipping: Two-Dimensional Clipping, Sutherland-Cohen Subdivision Line-Clipping Algorithm, Midpoint Subdivision Algorithm, Generalized Two-Dimensional Line Clipping for Convex Boundaries.

2D- Transformation: Representation of Points, Transformations and Matrix, Transformation of Straight Line, 2-D - Rotation, Reflection, Scaling, Combined Transformations, Translation and Homogeneous Coordinates, Translation, Rotation about an Arbitrary Point, Reflection through an Arbitrary Line.

3-D-Transformation: Representation of Points, 3D- Scaling, 3D- Shearing, 3D-Rotation, Three Dimensional Translation, 3D- Reflection, Multiple Transformations, Rotation about an Axis Parallel to a Coordinate Axis, Rotation about an Arbitrary Axis in Space, Three.

The Dimensional Perspective Geometry: Geometric Projection, Orthographic Projections, Oblique Projections, Perspective Transformations, Single-Point Perspective Transformation, Two-Point Perspective Transformation, Three-Point Perspective Transformation.

Hidden-Surface, Lines and Bezier Curve: Hidden Surfaces and Lines, Back-Face Detection, Back-Face Removal, Z-Buffers Algorithm, The Painter's Algorithm, Binary Space Partition, Franklin Algorithm, Cubic Belier Curve (No Derivations Needed), Properties of Bezier Curve, Joining Condition, Problems.

Multimedia and Animation: Multimedia, Multimedia Terms, Multimedia Hardware, Hardware Peripherals, Basic tools in Multimedia, Multimedia Building Blocks (Media Forms/Elements), Sound, Image, Animation, Video, JPEG, MPEG, DVI Indeo, P*64, Graphic File Formats, Multimedia Applications.

Books Recommended:
   (i) Hearn, D., & Baker, M. (1994). Computer graphics (2nd ed.). Englewood Cliffs, N.J.: Prentice-Hall.
   (ii) Hugues, J. (2014). Computer graphics: Principles and practice (3rd ed.). Upper Saddle River: Addison-Wesley.
   (iii) Rogers, D. (1998). Procedural elements for computer graphics (2nd ed.). Boston, Mass.: WCB/McGraw-Hill.
   (iv) Gibbs, S., & Tsichritzis, D. (1995). Multimedia programming: Objects, environments, and frameworks. New York: ACM Press;
   (v) Li, Z., & Drew, M. (2004). Fundamentals of multimedia. Upper Saddle River, NJ: Pearson Prentice Hall.
   (vi) Andleigh, P., & Thakrar, K. (1996). Multimedia systems design. Upper Saddle River, NJ: Prentice Hall PTR.

COURSE CODE	COURSE TITLE	CREDIT
CSE41P8	**Computer Graphics and Multimedia System Lab**	**0.75**

Experiments	Topics
01	A brief study of various types of input and output devices.
02	Program to implement a line using slope intercept formula.
03	Program to implement line using DDA algorithm.
04	Program to implement line using Bresenham's algorithm.
05	Program to implement circle using midpoint algorithm.
06	Program to implement translation of a line and triangle
07	Program to implement rotation of a line and triangle
08	Program to implement scaling transformation.
09	Program to implement 3d rotation about an arbitrary axis.
10	Program to implement Cohen Sutherland line clipping.
11	Program to implement Sutherland Hodgman polygon clipping.
12	Program to draw Bezier curve.
13	Program to draw b-spine curve.

Fourth Year Second Semester

COURSE CODE	COURSE TITLE	CREDIT
CSE4231	**Cryptography and Network Security**	3.0

Security Trends: Attacks and services, Classical crypto systems, Different types of ciphers, LFSR sequences, Basic Number theory, Congruence, Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem, Legendre and Jacobi symbols, Finite fields, continued fractions.

Simple DES: Differential crypto analysis, DES, Modes of operation, Triple DES, AES, RC4, RSA, Attacks, Primarily test, factoring.

Discrete Logarithms: Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key cryptosystems, Hash functions, Secure Hash, Birthday attacks, MD5, Digital signatures, RSA, ElGamal, DSA.

Authentication applications: Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME, IP security, Web Security, SSL, TLS, SET.

System security: Intruders, Malicious software, viruses, Firewalls, Security Standards.

Books Recommended:
   (i) Trappe, W., & Washington, L. (2006). Introduction to cryptography: With coding theory (2nd ed.). Upper Saddle River, N.J.: Pearson Prentice Hall.
   (ii) Stallings, W. (2013). Cryptography and network security: Principles and practice (Sixth ed.). Pearson.
   (iii) Mao, W. (2004). Modern cryptography: Theory and practice. Upper Saddle River, NJ: Prentice Hall PTR.
   (iv) Pfleeger, C., & Pfleeger, S. (2007). Security in computing (4th ed.). Upper Saddle River, NJ: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE4232	**Compiler Design**	3.0

Front End of Compilers: The structure of Compiler, Lexical analysis: Role of Lexical analyzer, Specification and recognition of tokens, Syntax Analysis: Top down parsing, Bottom up parsing, LR Parsers: SLR, CLR, and LALR.

Intermediate Code Generation: Syntax Directed Definitions, Evaluation orders for syntax directed definitions, Syntax Directed Translation schemes, Intermediate languages : Three address code, Syntax tree, Postfix code – Declarations – Type checking – Expression translation – Back patching.

Object Code Generation: Storage organization, Stack allocation space, Access to non-local data on the stack, Heap management, Issues in code generation, Design of code generator, Register allocation and assignment, Instruction selection by tree rewriting, Optimal code generation for expressions, Dynamic programming code generation.

Code Optimization: Basic blocks and Flow graphs, Optimization of basic blocks, Principal sources of optimizations, Data flow analysis, Constant propagation, Partial redundancy elimination, Peephole optimizations.

Parallelizing Compiler: Basic concepts and examples, Iteration spaces, Affine array indexes, Data reuse, Array data dependence, Finding synchronization free parallelism, Synchronization between parallel loops, Locality optimizations.

Books Recommended:

(i) Aho, A. (2007). Compilers: Principles, techniques, & tools (2nd ed.). Boston: Pearson/Addison Wesley.

(ii) Allen, R., & Kennedy, K. (2001). Optimizing compilers for modern architectures a dependence-based approach. San Francisco: Morgan Kaufmann.

(iii) Muchnick, S. (1997). Advanced compiler design and implementation. San Francisco, Calif.: Morgan Kaufmann.

(iv) Cooper, K., & Torczon, L. (2012). Engineering a compiler (2nd ed.). Amsterdam: Elsevier/Morgan Kaufmann.

(v) Holub, A. (1990). Compiler design in C. Englewood Cliffs, NJ: Prentice Hall.

COURSE CODE	COURSE TITLE	CREDIT
CSE42P3	Compiler Design Lab	0.75

Experiments	Topics
01	Lexical analyzer generators
02	Parser generators
03	Intermediate code generation of Expressions
04	Assignment statements with arrays, Control flow statements, Switch statements.
05	Identifying the various errors of a program like syntax error, logical error etc.
06	Code generation for any specific architecture supported by open source compilers.
07	Exploring and customizing different types of optimizations supported by any open source compiler
08	NFA and DFA design
09	**Case study:** Open source parallelizing compilers.

COURSE CODE	COURSE TITLE	CREDIT
CSE4234	**Mobile Application Development**	**3.0**

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.

Introduction to Mobile development IDE's: Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova, Offline access, Encrypted cache deprecated, Using JSONStore.

Understanding Mobile Applications: Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization, WebView overlay , Creating Authentication application: development for Apple iOS by using a login module, Device Analytics, Worklight Server Administration.

Windows Phone: Introduction to Windows Phone, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages.

Books Recommended:
  (i) Pradhan, A., & Deshpande, A. (2014). Composing Mobile Apps: Learn, Explore, Apply using Android (1st ed.). Wiley India Private Limited.
  (ii) McWherter, J., & Gowell, S. (2012). Professional mobile application development. Indianapolis, Ind.: John Wiley & Sons.

(iii) Burd, B. (2012). Android application development all-in-one for dummies. Hoboken: John Wiley.

(iv) Goldstein, N., & Bove, T. (2010). IPhone application development all-in-one for dummies. Hoboken, NJ: Wiley Pub.

(v) Lee, H., & Chuvyrov, E. (2012). Beginning Windows phone app development (3rd ed.). New York, N.Y.: Apress.

(vi) Schiller, J. (2006). Mobile communications (2.nd ed.). London: Addison-Wesley.

COURSE CODE	COURSE TITLE	CREDIT
CSE42P5	**Mobile Application Development Lab**	1.5

Experiments	Topics
01	Installing Android Environment like eclipse
02	Hello World Application
03	Sample Application about Android Resources
04	Sample Application about Layouts
05	Sample Application about Intents
06	Sample Application I about user interfaces
07	Sample Application II about user interfaces
08	Sample Application III about user interfaces
09	Sample Application of Animations
10	Sample Application about Android Data
11	Simple Project: Application Development

COURSE CODE	COURSE TITLE	CREDIT
CSE4246	**Project Work**	4.0

Learners will be assigned a project under a supervisor who will be a faculty of any recognized university and have experience in a relevant field. The project shall be completed either in groups consisting maximum of two members or individually.

COURSE CODE	COURSE TITLE	CREDIT
CSE4227	**Comprehensive VivaVoce**	2.0

At the end of the eighth semester, learners must appear in the comprehensive Viva-Voce examination. The examination shall be based on all courses and the viva-voce shall be conducted by a committee formed under the guidance of Article- 41 of the Examination regulation.

CONTACT INFORMATION

Address of the Study Center

1. Regional Center, Dhaka (5th Floor)
   Bangladesh Open University
   (Northern side of Dhaka College)
   Dhanmondi. Dhaka–1205
   Phone: (02) 96 73 669; Fax: +88-02-86 16 065.

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