UNIVERSITY OF RAJSHAHI

Faculty of Engineering

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Curriculum
B.Sc. Engineering
Session: 2018–2019

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RULES AND REGULATIONS FOR THE UNDERGRADUATE PROGRAM

1. Duration of Course and Course Structure (Ref. Academic Ordinance Faculty of Engineering (AOFE) article no-4)

1.1 The B. Sc. Engg. Programs shall extend over a period of four academic years, each of a normal duration of one calendar year, divided into 2 Semesters; (details are given in Section 7 of the ordinance).

1.2 The curricula of the B. Sc. Engg. Degree in the different departments shall be proposed by the Committee of Courses and approved by the Syndicate on the recommendation of the Academic Council.

1.3 The Committee of Courses shall review the curricula at least once in every Academic Year and recommend changes and revision, if any, to the Faculty, and then the Faculty will recommend to the Academic Council.

1.4 Teaching of the courses is reckoned in terms of credits and the credits allotted to various courses will be determined by the Committee of Courses under the following guidelines;

Nature of course	Contact hour/credit (in a semester)
Theoretical Lecture	: 1 hour/week
Laboratory/Project	: 2 - 3 hours/week
Field work	: 2 weeks of field work

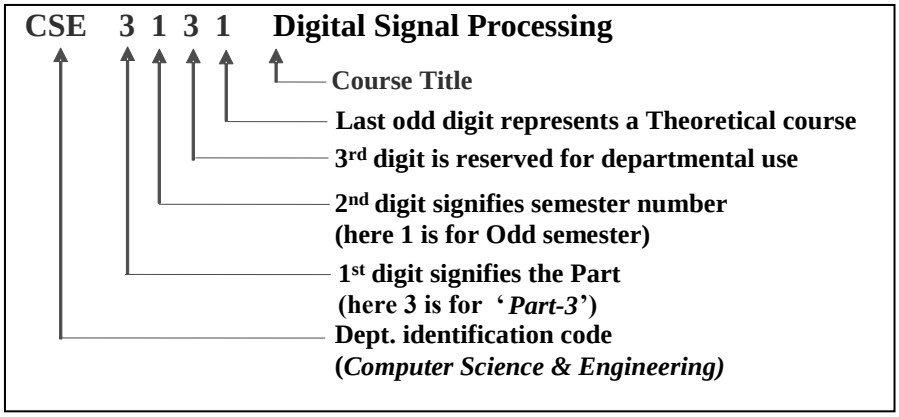
1.5 **Contact Hours/week:** The total contact hours for the regular students including lecture, tutorial and laboratory shall be between 24 - 42 periods per week, each period being 40 to 60 minutes in duration.

1.6 **Course Adviser**: In each degree-awarding department, one of the teachers nominated by the Academic Committee shall act as Course Advisorfor each academic year.

1.7 With the approval of Academic Committee, Course Advisor will prepare and announce the class routine, showing details of the lectures, course plan, class test, etc. at the start of each semester.

1.8 C**ourse Designation:** Each course is designated by a two to four letter word usually identifying the course offering department followed by a four-digit number with the following criteria without any space between letters and numerical.

(a) The first digit will correspond to the Part (year) in which the course is normally taken by the students, (b) The second digit will correspond the semester (1 for odd and 2 for even) in which the course is normally taken by the students, (c) The third digit will be reserved for departmental use for such things as to identify different areas within a department, (d) The last digit will be odd for theoretical, even for laboratory courses and ‘0’ for Board Viva voce and (e) The course designation system is illustrated by the following example.



2. Duration of Examination [Ref.:AOFEarticle no- 6]

Duration of Theoretical examination of different coursesat the end of semester shall be as follows:

Courses less than or equal to 2 Credits	2 Hours
Courses greater than 2 credits but less than or equal to 4 Credits	3 Hours

3. Academic Calendar [Ref.: AOFEarticle no- 7]

3.1 The academic year shall be divided into two semesters each having duration of not less than 11 teaching weeks.

3.2 There shall be final examinations at the end of each semester conducted by the respective Examination Committee of the Departments.

3.3 **An academic schedule** for the academic year shall be announced for general notification before the start of the academic year, on the approval of the Academic Committee. The schedule may be prepared according to the following guidelines:

Semester- Odd (19 weeks)	**Number of weeks**
Teaching	11 (55 working days)
Preparatory Leave	2
Examination Period	2 - 3
Result Publication	3 - 4 — **6**
	19
Inter Semester Recess	1
Semester- Even (19 weeks)	
Teaching	11 (55 working days)
Preparatory Leave	2
Examination Period	2 - 3
Result Publication	3 - 4 — **6**
	19
Vacation (Summer, Ramadan, and Others)	13
Total:	**52**

4.Attendance [Ref. AOFE article no-13]

In order to be eligible to appear, as a regular candidate, at the semester final examinations, a student shall be required to have attended at least 70% of the total number of periods of lectures/tutorials/laboratory classes offered during the semester in every course. A student whose attendance falls short of 70% but not below 60% in any course may be allowed to appear at the final examinations as non-collegiate student and he/she shall not be eligible for the award of any scholarship or stipend. A student, appearing the examination under the benefit of this provision shall have to pay in addition to the fees, the requisite fee prescribed by the syndicate for the purpose. Student having less than 60% attendance in any course will not be allowed to appear in the final

examinations of thesemester. An attendance report of the students will be prepared by the concerned course teacher and posted for information of the students. The basis of awarding marks for class participation and attendance is shown in the following Table.

Table-1 Distribution of Marks in Attendance

Attendance	Marks (%)	Remarks
90% and above	100	**Regular**
85% to less than 90%	90	
80% to less than 85%	80	
75% to less than 80%	70	
70% to less than 75%	60	
65% to less than 70%	50	**Non-collegiate**
60% to less than 65%	40	
less than 60%	0	

5. Class Test [Ref. AOFE article no- 16]

For theoretical courses of less than or equal to 2 credits there shall be at least three class tests and at least four class tests for greater than 2 credits in a semester. Previous class test marks will remain valid for the reported/ course improvement student if he/she is unable to appear at class test.

6. The Grading System [Ref. AOFE article no-14]

6.1 The letter grade system shall be used to assess the performance of the students as shown in the following Table:

Table-2 Grading System

Marks	Letter Grade (LG)	Grade Point (GP)
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	0.0
Incomplete	I	0.0

Absence of a candidate in an examination of a course in which he/she ought to have been present will be considered as if the candidate obtained zero marks ('F' grade) in that course.

6.2 A **Grade Point Average (GPA)**shall be calculated for each semester as follows:

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i} \qquad \text{(i)}$$

where, n is the number of courses offered during the semester, C_i is the number of credits allotted to a particular course and G_i is the grade point earned for that course.

6.3 A **YearlyGrade Point Average (YGPA**)shall be calculated for each academic year as follows:

$$\text{YGPA} = \frac{\sum_{j=1}^{2} C_j G_j}{\sum_{j=1}^{2} C_j} \qquad \text{(ii)}$$

Where 2 is the number of semesters, C_j is the number of credits allotted to the jth semester and G_j is the GPA earned for that semester.

6.4 The **Cumulative Grade Point Average (CGPA)** gives the cumulative performance of the students from the first year up to the end of the year to which it refers, and will be calculated as follows:

$$\text{CGPA} = \frac{\sum_{k=1}^{m} C_k G_k}{\sum_{k=1}^{m} C_k} \qquad \text{(iii)}$$

where, m is the total number of years being considered, C_k is the total number ofcredits registered during the kth year and G_k is the YGPA earned in that particular year.

6.5 A Cumulative Grade Point Average (CGPA) shall be calculated at the end of each academic year and to be communicated to the students along with the YGPAs. The individual grades of courses obtained by them for the semesters of the academic year will, however, be communicated at the end of individual semester by the Chairman of the Examination Committee.

6.6 YGPA will be calculated up to 3rd digit after decimal following the truncation rule whereas CGPA will be recorded up to the second place of decimal following the rounding rule. For instance, YGPA=3.2125 will be recorded as 3.212 but CGPA=3.335 will be recorded as 3.34.

Illustration: Suppose a student obtained following grades in Part-I odd semester:

B.Sc. Engg. Part-I Odd Semester	Credit	Letter Grade	GP
EEE 1111	**3**	B+	**3.25**
EEE 1112	**1**	A	**3.75**
CSE 1151	**3**	A+	**4**
CSE 1152	**2**	A-	**3.5**
CE 1152	**1**	A+	**4**
PHY 1121	**3**	F	**0**
PHY 1122	**1**	C+	**2.50**
MATH 1131	**3**	B+	**3.25**
ENG 1111	**2**	A	**3.75**
ENG 1112	**1**	A+	**4**

Therefore, GPA in the odd semester is

$$= \frac{3\times3.25+1\times3.75+3\times4+2\times3.5+1\times4+3\times0+1\times2.50+3\times3.25+2\times3.75+1\times4}{3+1+3+2+1+3+1+3+2+1}$$

$$= \frac{60.25}{20} = 3.0125 \approx 3.012$$

(GPA will be truncated to the third digit)

And let's assume that his/her GPA in Part-I Even Semester is = 3.132 and the total credits allotted for that semester is 20.

Therefore, YGPA of Part-Iexamination is $= \frac{20\times3.012+20\times3.132}{20+20} = 3.072$

(YGPA will be truncated to the third digit)
Similarly assume that, the student's YGPA for the other 3 Parts are as follows-

Semester/year	Credit	YGPA
Part-II	40	3.475
Part-III	40	2.963
Part-IV	40	3.338

Then his/her CGPA of four academic years is

$$\frac{40\times 3.072+40\times 3.475+40\times 2.963+40\times 3.338}{160}=3.212\approx 3.21$$

(CGPA will be recorded upto 2nd digit following the rounding rule. If the third digit is less than 5, it will be immediately truncated, but if the third digit is greater than or equal to 5, the second digit will be added by 1 and only the first two digits after decimal will be kept for record)

6.7 Earned Credit

The courses in which a student has obtained minimum 'D' in 'Theoretical courses' and 'C' in 'Laboratory courses and Board Viva-voce' or higher grade will be counted as credits earned by the student. Any course in which a student has obtained 'F' grade will not be counted towards his/her earned credit. 'F' grade will not be counted for GPA calculation but will stay permanently on the Grade sheet and transcripts.

7. Conducting Examination and Rules for Promotion [Ref. AOFE article no-15]

7.1 The academic year shall be divided into two semesters each having duration of not less than 11 teaching weeks (details are given in Section 7 of the Ordinance).

7.2 There shall be final examinations conducted by the concerned Examination Committee of the Departments at the end of each semester.

7.3 The results shall be finalized at the end of the even semester of the academic year. A student entering in an odd semester shall automatically move on to the next semester, unless he/she was barred from appearing at the final examinations at the end of the semester. Individual course grades and GPA shall be announced within a date ordinarily not later than three weeks after the end of the semester final examinations.

7.4 **Minimum passing grade:** The minimum passing grade in a theoretical course will be D and the minimum passing grade in a laboratory/project/field work/in-plant training/workshop/similar Courses (henceforth referred to as laboratory course) and Viva voce will be C.

7.5 **Promotion to higher class:**In order to be promoted to higher class a student must obtain the following requirements:

i) Yearly Grade Point Average (YGPA) of 2.25 or higher
ii) Credit point loss (F or I Grade) in the theoretical courses not more than 10.
iii) Minimum C grade in the laboratory courses and viva-voce.

7.6 **Course Improvement:** A promoted student may appear for only theoretical course improvement in the immediate next academic year for maximum 10 credit points to clear his/her F grade or to improve the grades on the courses in which less than B grade (including those of F grade) was obtained in Part-1, Part-2 and Part-3 examinations. In such case, the student has to give his/her choice of course/courses for course improvement in writing. If the student fails to clear his/her F grades in the first attempt, he/she shall get another (last) chance in the immediate next year to clear the F grades. In every case a student has to carry his previous marks on CA. In the case of student's failure to improve his/her course grade at the course improvement examination, the previous grade shall remain valid.

7.7 **Course Exemption:** Students who fail to be promoted to the next higher class shall be exempted from taking the theoretical and laboratory courses where they obtained grades equal to B or above. These grades would be counted in calculating GPA in the next year's examination results.

7.8 **Merit Position:** The YGPA obtained by a student in the semester final examinations will be considered for determining the merit position for the award of scholarships, stipends etc.

8. Publication of Results [Ref. AOFE article no-17]

8.1 **Award of degree**: In order to qualify for the B.Sc. Engg. degree, a student must have to earn minimum 150 credits and a minimum CGPAof2.25 within a maximum of six academic years. The result will be published in accordance with merit.

8.2 **Honors**: Candidates for Bachelor degree in engineering will be awarded the degree with Honors if their earned credit is 160 and CGPA is 3.75 or higher.

8.3 **Result Improvement:** A candidate obtaining B.Sc. Engg. within 4 or 5 academic years shall be allowed to improve his/her result, of maximum of 10 credit points (courses less than 'B' grade) of the Part-IV theoretical courses in the immediate next regular examination after publication of his/her result. No improvement shall be allowed for laboratory examinations and Board Viva-voce. If a candidate fails to improve CGPA with the block of new GP in total, the previous results shall remain valid.

8.4 **Readmission and Course Exemption:** If a student fails to obtain the degree within 4 or 5 academic year, he/she will be readmitted in Part-4 and will appear for the exam according to the clause 15.6. Course exemption rules will also be valid according to clause 15.7.

8.5 **Dean's List:** As a recognition of excellent performance, the names of students obtaining a cumulative GPA of 3.75 or above in two regular semesters in each academic year may be published in the Dean's List in the faculty. Students who have received an 'F' grade in any course during any of the two regular semesters will not be considered for Dean's List in that year.

8.6 **Recording of Result:** The transcripts in English will show the course designation, course title, credit, letter grade, grade point of individual courses, YGPA of each year, and finally, CGPA.

9. Eligibility for Examination[Ref. AOFE article no-23]:

9.1 A candidate may not be admitted to any semester final examination unless he/she has

- 9.1.1 Submitted application in the prescribed form to the Registrar/Vice-Chancellor for appearing at the examination,
- 9.1.2 Paid the prescribed examination fees, and all outstanding University and Hall dues,
- 9.1.3 Fulfilled the conditions for attendance in class and
- 9.1.4 Been barred by any disciplinary rules.

9.2 On special circumstances the Vice-Chancellor may permit a student to appear at the examination.

9.3 A student whose attendance falls short of 70% but not below 60% in any course as mentioned above may be allowed to appear at the final examinations as a non-collegiate student.

B.Sc. in
Computer Science & Engineering

B.Sc. in Computer Science & Engineering

The Computer Science and Engineering program combines a rigorous education in computer science with added emphasis on the physical and architectural underpinnings of modern computer system design. With a background that spans computer science and computer engineering, our graduates are able to address computing systems across the hardware-software spectrum.

Vision

To become a prominent department of Computer Science & Engineering producing competent professionals with research and innovation skills, inculcating moral values and societal concerns.

Mission

1. Provide learning ambience to generate innovative and problem solving skills with professionalism.
2. Create facilities and expertise in advanced computer technology thereby promote research.
3. Enhance Industry Institute Interaction program to get acquainted with corporate culture.
4. Induce ethical values and spirit of social commitment.

The Program Educational Objectives:

The Computer Science and Engineering undergraduate program educational objectives are that our alumni/ae:

1. Practice as computing professionals, conducting research and/or leading, designing, developing, or maintaining projects in various technical areas.
2. Apply the ethical and social aspects of modern computing technology to the design, development, and usage of computing artifacts.
3. Enhance their skills and embrace new computing technologies through self-directed professional development and post-graduate training or education.

Program Learning Outcomes (PLO):

The following Program Learning Outcomes (student Outcomes) describes the skills imparted by our B.Sc. in Computer Science & Engineering program:

P1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals to the solution of complex problems of computer and information technology.

P2 **Problem analysis**: Identify, formulate, research and analyze complex computer engineering problems

P3 **design/development of solutions**: Design solutions for complex computer engineering problems and design system components or processes that meet the specified needs with technological concerns

P4 **Investigation:** Conduct investigations of complex computer science and technology problems, considering experimental design, data analysis and interpretation.

P5 **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern computer engineering and ICT tools.

P6 **The engineer and society**: Apply reasoning informed by contextual knowledge to develop the computer technologies for society benefits.

P7 **Environment and sustainability**: Understand the impact of professional computer engineering solutions in societal and environmental contexts and demonstrate the knowledge for sustainable development.

P8 **Ethics:** Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice

P9 **Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.

P10 **Communication:** Communicate effectively about complex computer science and engineering activities with the engineering community and with society at large in both oral and written.

P11 **Project management and finance**: Demonstrate knowledge and understanding of computer engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.

P12 **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

Distribution of Courses:

The total credits have been set to **160 in eight semesters**for the program of B.Sc. in Computer Science and Engineering in order to achieve Program Educational Objectives as well as to ensure the Program Learning Outcomes.The following credit distribution has been designed from the above perspective and based on these credit distributions, different courses are offered in different semester as given below.

Summary of the subject-wise distributions oftotal credits

Course Type	Marks	% of Marks	Credits
Mathematics and Basic Sciences	**625**	**15.63**	**25**
(a) Mathematics	375	9.38	15
(b) Statistics	100	2.50	4
(c) Physics	75	1.88	3
(d) Chemistry	75	1.88	3
Humanities	**200**	**5.00**	**8**
(a) Economics	50	1.25	2
(b) Accounting	50	1.25	2
(c) English	50	1.25	2
(d) Law	50	1.25	2
Basic and Major Engineering	**3175**	**79.38**	**127**
(i) Basic Engineering with Lab	**200**	**5.00**	**8**
(ii) Major Engineering	**2975**	**74.38**	**119**
(a) Theoretical	2100	52.50	84
(b) Laboratory	825	20.63	33
(c) Board viva-voce	50	1.25	2
Total	**4000**	**100.00**	**160**

Summary of the year-wise distributions oftotal credits

Year	Semester	Credits distributions
First Year (Part 1)	Odd	21
	Even	19
Second Year (Part 2)	Odd	19
	Even	21
Third Year (Part 3)	Odd	20
	Even	20
Fourth Year (Part 4)	Odd	20
	Even	**20**

Courses offered in Part-I, Odd Semester

Code	Course Title	Marks	Credit
ENG1111	Technical and Communicative English	50	2
MATH1111	Algebra, Trigonometry and Vector	75	3
CHEM1111	Physical and Inorganic Chemistry	75	3
EEE1131	Electrical Circuit and Electronics	75	3
EEE1132	Electrical Circuit and Electronics Lab	25	1
CSE1111	Introduction to Computer Systems	75	3
CSE1112	Computer Maintenance and Engineering Drawing Lab	25	1
CSE1121	Structural Programming Language	75	3
CSE1122	Structural Programming Language Lab	50	2
	Total	**525**	**21**

Courses offered in Part-I, Even Semester

Code	Course Title	Marks	Credit
ECON1211	Economics	50	2
STAT1211	Statistics for Engineers	50	2
MATH1211	Differential and Integral Calculus	75	3
PHY1221	Applied Electricity and Magnetism	75	3
CSE1211	Introduction to Digital Electronics	75	3
CSE1212	Introduction to Digital Electronics Lab	25	1
CSE1221	Object Oriented Programming	75	3
CSE1222	Object Oriented Programming Lab	50	2
	Total	**475**	**19**

Courses offered in Part-II, Odd Semester

Code	**Course Title**	**Marks**	**Credit**
ACCO2111	Industrial Management and Accountancy	50	2
STAT2111	Theory of Statistics	50	2
MATH2111	Matrices and Differential Equations	75	3
CSE2111	Digital System Design	75	3
CSE2112	Digital System Design Lab	25	1
CSE2121	Data Structure	75	3
CSE2122	Data Structure Lab	25	1
CSE2131	Discrete Mathematics	75	3
CSE2142	Software Development Lab I	25	1
	Total	**475**	**19**

Courses offered in Part-II, Even Semester

Code	Course Title	Marks	Credit
LAW2211	Cyber and Intellectual Property Law	50	2
MATH2231	Numerical Methods	50	2
MATH2232	Numerical Methods Lab	25	1
MATH2241	Linear Algebra	75	3
CSE2211	Theory of Computation	75	3
CSE2221	Design and Analysis of Algorithms	75	3
CSE2222	Design and Analysis of Algorithms Lab	25	1
CSE2231	Computer Architecture and Organization	75	3
CSE2232	Computer Architecture and Organization Lab	25	1
CSE2242	Technical Writing and Presentation	25	1
CSE2252	Software Development Lab II	25	1
	Total	**525**	**21**

Courses offered in Part-III, Odd Semester

Code	Course Title	Marks	Credit
CSE3111	System Analysis and Design	75	3
CSE3121	Database Management Systems	75	3
CSE3122	Database Management Systems Lab	25	1
CSE3131	Digital Signal Processing	75	3
CSE3132	Digital Signal Processing Lab	25	1
CSE3141	Compiler Design	75	3
CSE3142	Compiler Design Lab	25	1
CSE3151	Computer Networks	75	3
CSE3152	Computer Networks Lab	25	1
CSE3162	Software Development Lab III	25	1
	Total	**500**	**20**

Courses offered in Part-III, Even Semester

Code	Course Title	Marks	Credit
CSE3211	Software Engineering	75	3
CSE3212	Software Engineering Lab	25	1
CSE3221	Computer Graphics	75	3
CSE3222	Computer Graphics Lab	25	1
CSE3231	Microprocessor and Assembly Language	75	3
CSE3232	Microprocessor and Assembly Language Lab	25	1
CSE3241	Operating System and System Programming	75	3
CSE3242	Operating System and System Programming Lab	25	1
ICE3261	Communication Engineering	75	3
ICE3262	Communication Engineering Lab	25	1
	Total	**500**	**20**

Courses offered in Part-IV, Odd Semester

Code	Course Title	Marks	Credit
CSE4111	Parallel Processing and Distributed System	75	3
CSE4112	Parallel Processing and Distributed System Lab	25	1
CSE4121	Object Oriented Design and Design Patterns	50	2
CSE4122	Object Oriented Design and Design Patterns Lab	25	1
CSE4131	Computer Simulation and Modeling	75	3
CSE4132	Computer Simulation and Modeling Lab	25	1
CSE4141	Computer Peripherals and Interfacing	75	3
CSE4142	Computer Peripherals and Interfacing Lab	25	1
Option I (T)	Theory: Should be selected from Table-I	75	3
Option I (L)	Lab course based on Option-I (T)	25	1
CSE4192	Thesis/ Project (Part I)	25	1
	Total	**500**	**20**

Table-I: Option I

Code	Course Title	Marks	Credit
CSE4151	Design of VLSI Circuits and Systems	75	3
CSE4152	Design of VLSI Circuits and Systems Lab	25	1
CSE4161	Management Information System	75	3
CSE4162	Management Information System Lab	25	1
CSE4171	Computational Geometry	75	3
CSE4172	Computational Geometry Lab	25	1
CSE4181	Digital Image Processing	75	3
CSE4182	Digital Image Processing Lab	25	1

Courses offered in Part-IV, Even Semester

Code	Course Title	Marks	Credit
CSE4211	Artificial Intelligence	75	3
CSE4212	Artificial Intelligence Lab	25	1
CSE4221	Web Engineering	75	3
CSE4222	Web Engineering Lab	25	1
CSE4231	Cryptography and Network Security	75	3
CSE4232	Cryptography and Network Security Lab	25	1
Option II (T)	Theory: Should be selected from Table-II	75	3
Option II (L)	Lab course based on Option-II (T)	25	1
CSE4280	Board viva-voce	50	2
CSE4292	Thesis/ Project (Part II)	50	2
	Total	**500**	**20**

Table-II: Option II

Code	Course Title	Marks	Credit
CSE4241	Wireless Communication	75	3
CSE4242	Wireless Communication Lab	25	1
CSE4251	Multimedia System	75	3
CSE4252	Multimedia System Lab	25	1
CSE4261	Distributed Database Management System	75	3
CSE4262	Distributed Database Management System Lab	25	1

Offered CoursesVs Program Learning Outcome mapping

Course ID	Course Title	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
ENG1111	Technical and Communicative English	●	●		●	●							●
MATH1111	Algebra, Trigonometry and Vector	●	●	●	●		●				●		
CHEM1111	Physical and Inorganic Chemistry												`
EEE1131	Electrical Circuit and Electronics	●	●	●	●	●							
EEE1132	Electrical Circuit and Electronics Lab												
CSE1111	Introduction to Computer Systems	●		●									●
CSE1112	Computer Maintenance and Engineering Drawings Lab												
CSE1121	Structural Programming Language		●	●	●	●							
CSE1122	Structural Programming Language Lab		●	●	●	●				●			
										●			
ECON1211	Economics	●	●		●	●	●						
STAT1211	Statistics for Engineers	●	●	●									
MATH1211	Differential and Integral Calculus	●	●	●		●							
PHY1221	Applied Electricity and Magnetism												
CSE1211	Introduction to Digital Electronics	●	●	●		●							
CSE1212	Introduction to Digital Electronics Lab												
CSE1221	Object Oriented Programming		●	●	●	●				●		●	
CSE1222	Object Oriented Programming Lab		●	●	●	●				●		●	

Offered CoursesVs Program Learning Outcome mapping

Course ID	Course Title	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
ACCO2111	Industrial Management and Accountancy	●	●	●			●					●	
STAT2111	Theory of Statistics	●	●	●	●								
MATH2111	Matrices and Differential Equations	●	●	●		●	●						
CSE2111	Digital System Design	●	●	●	●								●
CSE2112	Digital System Design Lab												
CSE2121	Data Structure	●	●			●	●						●
CSE2122	Data Structure Lab												
CSE2131	Discrete Mathematics	●	●	●	●	●	●						
CSE2142	Software Development Lab I												
LAW2211	Cyber and Intellectual Property Law	●	●		●	●	●						
MATH2231	Numerical Methods	●	●	●		●	●						
MATH2232	Numerical Methods Lab												
MATH2241	Linear Algebra												
CSE2211	Theory of Computation		●	●	●	●				●	●	●	
CSE2221	Design and Analysis of Algorithms												
CSE2222	Design and Analysis of Algorithms Lab												
CSE2231	Computer Architecture and Organization	●	●	●	●		●						●
CSE2232	Computer Architecture and Organization Lab												
CSE 2242	Technical Writing and Presentation												
CSE 2252	Software Development Lab II												

Offered CoursesVs Program Learning Outcome mapping

Course ID	Course Title	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CSE3111	System Analysis and Design	●	●	●	●	●			●	●	●	●	
CSE3121	Database Management Systems	●	●	●	●	●	●						●
CSE3122	Database Management Systems Lab												
CSE3131	Digital Signal Processing	●	●	●			●						●
CSE3132	Digital Signal Processing Lab												
CSE3141	Compiler Design	●	●	●	●								●
CSE3142	Compiler Design Lab												
CSE3151	Computer Networks	●	●	●		●	●						
CSE3152	Computer Networks Lab												
CSE 3162	Software Development Lab III												
CSE3211	Software Engineering	●	●		●	●	●			●		●	
CSE 3212	Software Engineering Lab												
CSE3221	Computer Graphics												
CSE3222	Computer Graphics Lab												
CSE3231	Microprocessor and Assembly Language	●	●	●	●		●						
CSE3232	Microprocessor and Assembly Language Lab												
CSE3241	Operating System and System Programming	●	●	●	●	●							●
CSE3242	Operating System and System Programming Lab												
ICE3261	Communication Engineering	●	●										
ICE3262	Communication Engineering Lab												

Offered CoursesVs Program Learning Outcome mapping

Course ID	Course Title	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CSE4111	Parallel Processing and Distributed System	●	●	●	●		●						
CSE4112	Parallel Processing and Distributed System Lab												
CSE4121	Object Oriented Design and Design Patterns												
CSE 4122	Object Oriented Design and Design Patterns Lab												
CSE4131	Computer Simulation and Modeling	●	●	●		●							
CSE4132	Computer Simulation and Modeling Lab												
CSE4141	Computer Peripherals and Interfacing	●	●	●	●		●						
CSE4142	Computer Peripherals and Interfacing Lab												
Option I (T)	Theory: Should be selected from Table-I												
Option I (L)	Lab course based on Option-I (T)												
CSE4192	Thesis/Project (Part I)												
CSE4151	Design of VLSI Circuits and Systems												
CSE4152	Design of VLSI Circuits and Systems Lab												
CSE4161	Management Information System	●	●	●	●	●	●						
CSE4162	Management Information System Lab												
CSE4171	Computational Geometry	●	●		●	●							
CSE4172	Computational Geometry Lab												
CSE4181	Digital Image Processing	●		●	●	●							●
CSE4182	Digital Image Processing Lab												

Offered CoursesVs Program Learning Outcome mapping

Course ID	Course Title	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CSE4211	Artificial Intelligence	●	●	●	●	●	●						
CSE4212	Artificial Intelligence Lab												
CSE4221	Web Engineering												
CSE4222	Web EngineeringLab												
CSE4231	Cryptography and Network Security	●	●	●	●								
CSE4232	Cryptography and Network Security Lab												
Option II (T)	Theory: Should be selected from Table-II												
Option II (L)	Lab course based on Option-II (T)												
CSE4280	Board viva-voce												
CSE4292	Thesis/Project (Part II)												
CSE4241	Wireless Communication	●	●	●		●							
CSE4242	Wireless Communication Lab												
CSE4251	Multimedia System	●	●	●	●	●							
CSE4252	Multimedia System Lab												
CSE4261	Distributed Database Management System	●	●	●									
CSE4262	Distributed Database Management System Lab												

Details of the
Offered Courses
of
B.Sc. in
Computer Science and Engineering

Part-I, Odd Semester

ENG 1111: Technical and Communicative English

Credits: 2 **Contact Hours:** 26
Year: First Semester**:** Odd

Prerequisite: None
Motivation To be able to communicate through one of the most dominating language of the world, which is having its impact on every field of work, English?

Course Objective:
The course aims to give students a formal and methodical exposure to Academic and Technical writing and professional communication skills. It intends to teach students the tools for writing technical error free English. It also intends to grow effective and fast reading skill among the students. Students will also be taught to speak English with correct pronunciation and phonetics.

CLO (Course Learning Outcome):			
CLOs	**After successfully completing this course, students will be able**	**PLO mapping**	
CLO1	To **understand** and extract the essential information from a written or spoken text on a specific topic.	P1	
CLO2	To **practice** a variety of social functions including greetings, introductions and farewells. ,	P1	P2
CLO3	To**investigate** and Integrate information from various texts on the same subject, in order to write or speak on the subject knowledgeably.	P4	P12
CLO4	To **produce** a well-organized academic essay.	P5	P2

Evaluation/ Assessment System: Students will be evaluated out of total **50 Marks**. There are different types of assessment tools. In**the final written** examination, total time **is 2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√				√	√
CLO2	√			√	√	√
CLO3		√	√		√	√
CLO4		√	√		√	√

Course Contents:

Grammar: Grammatical principles, modals, phrases & idioms, prefixes & suffixes, sentence structures, WH & yes/ no questions, conditional sentences.

Vocabulary: Technical & scientific vocabulary, defining terms.

Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.

Reading: Comprehension of technical & non-technical materials-skimming, scanning, inferring & responding to context.

Technical Writing: Paragraph & composition writing on scientific & other themes, report writing, research paper writing, library references.

Professional communication: Business letter, job application, memos, quotations, tender notice.

Text Book:

1. A. J. Thomson & A. V. Martinet : **A Practical English Grammar**, *Oxford University Press*
2. John M. Lannon : **Technical Writing**, *Scott Foresman& Co.*

Reference Books:

1. A. Ashley : **Oxford Handbook of Commercial Correspondence**, *Oxford University Press*
2. John Swales : **Writing Scientific English**, *Cengage Learning Australia*
3. Robert J. Dixson : **Complete Course in English**, *Prentice Hall*

MATH1111: Algebra, Trigonometry and Vector

Credits: 3 **Contact Hours:** 39
Year: First **Semester:** Odd

Prerequisite: None
Motivation To introduce students with Algebra, complex variables and vector analysis and their uses in engineering.

Course Objective:
The main objective of this course is to introduce the fundamentals of Algebra to solve some mathematical equation. This course teaches the students to understand trigonometric functions and calculating their values. The course also introduces the study of vectors and Euclidean geometry, lines and planes in three-dimensional space.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** sets, relation and function and to solve the systems of linear equation.	P1	
CLO2	To**Apply** the concepts of complex variable to real world phenomena such as electrical networks, communication networks, and other engineering majors	P1	P2
CLO3	To **describe** essential concepts of a vector both as a geometric object and an algebraic object; add and subtract vectors geometrically and algebraically;	P3	P4
CLO4	To**improve**the ability to communicate via the language of mathematics with the abstract world.	P6	P10

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks**. There are different types of assessment tools.In**the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√		√	√	√
CLO4			√		√	

Course Contents:

Algebra of sets, De Morgan's rule, relation & function. Determinants: Properties and Cramer's rule.

Theory of Equations: Theorem, and relation between roots and coefficients. Solution of cubic equations.

De Moiver' theorem. Deduction from De Moiver's theorem.

Functions of complex arguments. Gregory's series. Summation of series. Hyperbolic functions.

Vector Addition, Multiplication & Differentiation.

Definitions of line, surface and volume integral. Gradient of scalar function, Divergence and curl of vector function. Physical significance of gradient, divergence and curl. Integral forms of gradient, divergence and curl, Divergence Theorem, Stoke's theorem, Green's theorem and Gauss's theorem.

Text Book:

1. H. S. Hall and S. R. Knight : **Higher Algebra**, *MacMillan Publications, Arihant Publishers*

Reference Books:

1. B. C. Das and B. N. Mukherjee : **Higher Trigonometry***, U. N. Dhur and Sons*
2. M. R. Spiegel, S. Lipschutz, and D. Spellman : **Vector Analysis and An Introduction to Tensor Analysis**,*McGraw-Hill*
3. W. S. Burnside and A. W. Panton : **Theory of Equations**, *Nabu Press*
4. Samuel Barnard and James M. Child : **Higher Algebra**, *MacMillan Publications*

CHEM1111: Physical and Inorganic Chemistry

Credits: 3 **Contact Hours:** 39
Year: First **Semester:** Odd

Prerequisite: None
Motivation To know basics of physical and inorganic chemistry.
Course Objective:
As per standards, the engineering graduates need to study some basic science courses like physics, chemistry, mathematics in their undergraduate courses. The aim of this course is to review the basic knowledge of chemistry that they have learned in high school level as well as prepare them for a higher level of study. The physical and inorganic chemistry knowledge expected to help the CS graduates in understanding the environmental impacts created by their designed systems and the way to resolve the negative issues.

CLO (Course Learning Outcome): After successfully completing this course, students will be able			
CLOs	**Course Learning Outcomes**	**CLO mapping**	
CLO1	To **explain** the different terminologies related with the physical and inorganic chemistry	P1	P2
CLO2	To **explain**the internal chemical operations of devices related to computer systems like semiconductors, batteries.	P2	
CLO3	To **choose** the right elements for the right situation based on their chemical bonding	P2	P3
CLO4	To **understand**atomic boding of semiconductor devices and their behavior in compound situations like excessive high or low temperature.	P3	

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Electrochemistry:Conductors, Electrolytes and Electrolysis; Faradays Laws of Electrolysis and their significance. Ohm's law and electrolytic conductances; Theories for electrolytic conductance (Arrhenius& Debye-Hükel). Ionic mobility, Kohlrausch's law, Tranference Number and its determination; Activities, activity coefficient and Debye-Hükel limiting law.Electrochemicalcells(Electrolytic and Galvanic/Voltaic):Electrode reaction and potentials. Reference electrodes; Reversible and concentration cells,Storage Batteries(or accumulators).

Chemical Equilibrium and Kinetics: Equilibrium and Equilibrium constants, Kc, Kp, Kx. Rate of reaction and rate constants; Le Chatelier principle and its application. Order and molecularity of a reaction; integrated rate expressions & half- lives of zeroeth, first and second order reactions. Determination of order &

temperature dependence of a reaction; energy of activation and Arrhenius equation. Transition-state theory of reaction rates. Characteristics of catalysis, promoters and inhibitors.

Surface Chemistry and Colloids: Adsorption and sorption; Characteristics of physical and chemical adsorptions. Fruendlich, Langmuir and Gibb's Adsorption isotherms; The BET equation. Crystalloids, Colloids and their classification, preparation, properties (kinetic, colligative, optical & electrical) and importance,=. Original pf charge and stability of colloids (sols), Gold number; colloidal electrolytes. Elementary idea about emulsions and gels.

Atomic structure and Periodic Table: Modern concept of atomic structure and Periodic Table; related principles and Laws. Constitution and Periodic properties of elements (ionization potential, electronigativety, electron affinity, atomic and ionic radii). Grouping of elements, their properties and uses. Isotopes and radioactivity.
Electronic Theory of Valency and Chemical Bonding: Different types of bonds (ionic, covalent, co-ordinate, hydrogen and metallic) Classification of solids on the basis of bonding and their properties. Atomic orbitals and their hybridization; valency bond and Molecular orbital theories.
Chemistry of Transition Elements, Lanthanides and Actinides: Definitions, electronic configurations, preparations (nuclear transformations), general properties and uses.

Text Book:

1. R. D. Madan : **Modern Inorganic Chemistry,***S. Chand Publishers*
2. M. M. Haque and M. A. Nawab : **Principles of Physical Chemistry**, *Nawab Publications*

Reference Book:

2. Esmarch S. Gilreath : **Fundamental Concepts in Inorganic Chemistry**, *McGraw-Hill*
3. G. M. Barrow : **Physical Chemistry**, *McGraw-Hill*
4. W. J. Moore : **Physical Chemistry**, *Orient BlackswanPvt Ltd.*
5. Keith J. Laidler, John H. Meiser : **Physical Chemistry**, *Houghton Mifflin Company*.
6. S. Z. Haider : **Modern Inorganic Chemistry,** *Friends International.*
7. Audrey L. Companion : **Chemical Bonding**, *McGraw-Hill*
8. F. Albert Cotton, Geoffrey Wilkinson, Paul L. Gaus : **Basic Inorganic Chemistry**, *Wiley*
9. Donald K. Sebera : **Electronic Structure and Chemical Bonding**, *Wiley*

EEE 1131: Electrical Circuit and Electronics

Credits: 3 **Contact Hours:** 39
Year: First Semester: Odd

Prerequisite: None
Motivation To develop basics knowledge on Electrical circuits and Electronics
Course Objective:
The knowledge on electrical circuits and electronics are highly significant to develop expertise on computer hardware. From this perspective, the major objectives of this course are to build necessary background on electrical circuits and electronics required to be a computer engineer. The student will study circuit theory, properties of electronic devices and their operational principle, measuring devices etc.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **identify** different types of electrical network and solve them for current and voltage	P1	P2
CLO2	To **understand** the characteristic of Diode, Transistor, FET. MOSFET, OpAmp	P1	P2
CLO3	To **construct** electronic circuit to operate different semiconductor devices	P3	P4
CLO4	To **operate** different measuring instruments, meters and oscilloscope	P3	P5

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools.In**the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Networks Analysis: Kirchhoff's laws; Superposition theorem; Millman's theorem; Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Mesh and Node circuit analysis, Reduction of complicated networks, T and p-section network.

Semiconductor Diodes: Semiconductor, n-and p-type semiconductors, p-n junction diode and their V-I characteristics, Zener diode, half-and full wave rectifiers, voltage regulation using Zener diodes.

Transistor: Transistor action, transistor biasing, DC characteristics of CE, CB and CC configurations. Transistor Amplifiers and Oscillators: CE, CB and CC amplifiers, current, voltage and power gains, frequency responses, feedback, positive and negative feedback, oscillators and masturbators, astable and monostablemultivibrator.

Operational Amplifier: Difference amplifier, CMRR, Ideal operational amplifier, Inverting amplifier, Non-inverting amplifier, General purpose IC operational amplifier, Integrator, Differentiator, Comparator and Converter.

Optoelectronic Devices: PN photodiode, Phototransistor, Solar cell, Photoconductive cell, Photovoltaic, Sensors, LED, LCD, Alphanumeric display, Photo couplers, Photodiode, LDR.

Instrumentation: Avometer, signal generator, oscilloscope.

Text Book:

1. S.G. Tarnekar, A.K. Teraja, B.L. Theraja : **Digital Systems: Principles and Applications (Part I and IV),** *S. Chand*

Reference Books:

1. Albert Paul Malvino : **Electronic Principles,** *Career Education*
2. Robert L. Boylestad : **Introductory Circuit Analysis,** *Pearson*

EEE1132: Electrical Circuit and Electronics Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on EEE1131

CSE1111: Introduction to Computer Systems

Credits: 3 **Contact Hours:** 39
Year: First **Semester:** Odd

Prerequisite: None
Motivation To accrue adequate fundamental knowledge required to build a sound base for studying computer science.

Course Objective:

In order to study some engineering course, a student must have some clear concept about the fundamental terms and terminologies of that subject. The objective of this course is to be able the student to understand the fundamental terminologies of computer science. They will be trained to construct a workstation computer from scratch. They will be demonstrated the operation of computers and its elements.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	PLO mapping	
CLO1	To **explainthe** fundamental terminologies of computer science.	P1	P3
CLO2	To **describe** the working principle of different types of computers and its peripherals.	P1	P3
CLO3	To **design** and construct workstations using available hardware & software in market.	P3	P12
CLO4	To **apply** his/her accrued knowledge to detect, analyze and recommend solutions for the problems related to the computer system and its networks.	P1	P3

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Computer Basics: Introduction to Studying Computers, History and development of Computers, Generation of Computers, Types of Computers.

Computer Hardware and Peripherals: Basic Units of Computer Hardware, Keyboard, Mouse, Internal structure of CPU, Functions of RAM, ROM and Cache memory, Basic functional mechanism of HDD and CD-ROM, Different types of Monitors, Impact and Non-Impact Printers, Scanner, Plotter, Typical Computer specifications.

Software: Classifications, System software, Operating system concepts and importance, components and basic functions of DOS, Windows operating system, Application software's and Utility programs, Computer Virus.

Data Processing: Concepts of Data, Information, and Database, Traditional File Processing, and DBMS.

Computer Networks: Computer networks and its goals, Basic concepts on LAN, MAN, WAN and Internet systems, Internet services, Functions of Modem in Internet.

Text Books:

1. Peter Norton : **Introduction to Computer**, McGraw-hill Publishers
2. J. Stanley Warford : **Computer Systems,** Jones & Bartlett Publishers

Reference Books:

1. P. Norton : **Inside the PC,** Sam Publishers
2. L. Rosch : **Hardware Bible**, Braddy Publishing, Indianapolis
3. Subramanian : **Introduction to Computers**, Mcgraw-hill Inc.

CSE1112: Computer Maintenance and Engineering Drawing Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE1111

CSE1121: Structural Programming Language

Credits: 3 **Contact Hours:** 39
Year: First, **Semester:** Odd

Prerequisite: None
Motivation To introduce a basic concepts of programming languages.
Course Objective:
The main objective of this course is to provide necessary knowledge on implement algorithms efficiently, develop alternative algorithms, Design, develop, debug and test programs in C programming language to solve problems related to collecting, processing and storing data, get used to with programming tools (such as compilers, linkers and debuggers), standard libraries and operating system functions to support program execution.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **learn** techniques to implement algorithms efficiently in a C programming language	P1	P2
CLO2	To **develop** alternative algorithms for programming problems	P3	
CLO3	To c**ompare** efficient implementation and typical implementation of algorithms	P4	
CLO4	To **design**, develop, debug and test programs in C programming language to solve problems related to collecting, processing and storing data.	P3	
CLO5	To i**dentify** and explain the use and workings of programming tools (such as compilers, linkers and debuggers), standard libraries and operating system functions to support program execution.	P3	P4
CLO6	To d**emonstrate** the understanding and the ability to follow professional programming practices to align with industry expectations.	P2	
CLO7	To c**ommunicate** effectively and collaborate as a team member to solve complex problems using C programming language.	P9	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

- Define, distinguish and give examples of hardware/software, computer programs/algorithms
- Explain the concept of a variable and declare, initialize and modify variables of data types int, double and char
- Create and comment simple C-programs that may print text, special characters and variables to the screen with controlled formatting

- Create simple C-programs that utilize for-loops to repeat blocks of instructions
- Use logical conditions to control the flow of a program via branch statements (if-else), repetition (for or while loop) and nesting of these structures
- Create and modify arrays to store integer and floating-point numbers and explain how arrays are organized in memory
- Create null-terminated arrays of characters to store and modify strings (of characters)
- Sort and search arrays of numbers and characters using bubble sort, selection sort, linear search and bisection
- Break a complex programming task into several functions to which you pass arguments
- Recall how computer memory is organized to store variables and arrays
- Find the address of a variable
- Perform simple pointer arithmetic
- Visualize the concept of a pointer and use it to pass variables to functions by reference to modify them via the function
- Apply pointer arithmetic to address elements of both one-dimensional and multi-dimensional arrays
- Use arrays of strings to store lists of strings in one array variable
- Control memory usage by dynamically allocating and freeing memory at runtime
- Define new data types (structures) to store multiple data items in one variable and create, initialize and modify variables of these new types
- Find and explain the memory usage of a structure and use pointers to structures and the direct and indirect member selection operators to access members of structures
- Create linked lists of structures with dynamic memory allocation at runtime
- Sort or search linked lists of structures

Text Book:

1. David Griffiths and Dawn Griffiths : **Head first C is written**
2. Herbert Schildt : **C: The Complete Reference**

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie : **The C Programming Language**
2. YashavantKanetkar : **Let Us C is written**

CSE1122: Structural Programming Language Lab

50 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
2 Credit, 52 Contact hours

Laboratory works based on CSE1121

Part-I, Even Semester

ECON 1211: Economics

Credits: 2 **Contact Hours:** 26
Year: First **Semester:** Even

Prerequisite: None
Motivation To introduce the complex concept, contribution and necessity of modern economics.

Course Objective:
The main objective of this course is to teach students how markets and other governance structures organize core economic activities, such as production, distribution, and consumption, and the growth of productive resources. Students will learn about the determinants of macroeconomic conditions such as national output, employment, inflation etc.Students will also become familiar with the origins and implications of processes of international economic integration and differentiation.economic policy.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To**understand** of the Bangladesh and world economies.	P1	
CLO2	To **identify** the key theoretical models in micro, macro and econometrics, as well as the theoretical frameworks in several sub-fields.	P2	
CLO3	To **apply** economic theory and the statistical tools of economics to specific problems or questions.	P4	P5
CLO4	To **organize**, **interpret** and **analyze** economic data.	P5	P6

Evaluation/ Assessment System: Students will be evaluated out of total **50 Marks**. There are different types of assessment tools. In **the final written** examination, total time**is2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√	√

Course Contents:

Basic Concepts of Economics: Definition and subject matter of Economics; Microeconomics vs macroeconomics; Law of Economics; Central economic problems of every society; Different economic systems; Economics and Engineering.

Theory of Demand, Supply and Consumer Behavior: Law of Demand; Demand schedule and demand curve; Supply law, Supply schedule and supply curve; Shift in demand and supply; Equilibrium in the market; Elasticity of demand and supply

Production and Costs and Theory of the Firm: Meaning of production; Factors of production; Concepts of total, average and marginal costs, fixed and variable costs.

Theory of the Firm: Perfect competition and monopoly; Total, average and marginal revenue of a firm; Average and marginal revenue under perfect competition and monopoly; Firm's Equilibrium; Equilibrium of firm under perfect competition and monopoly.

The Input-Output Analysis: Meaning of input-output analysis; Input-output analysis model; balance equation; coefficient matrix; Determination of final demand vector.

Basic Concepts of Macroeconomics: Growth; Unemployment; Inflation; Philips Curve, Business cycle; Circular flow of economics; Two, three and four sector economics.

National Income accounting and determination: Concepts of GNP, GDP and national income; Methods of national income accounting; Problems of national income accounting; Keynesian model of national income determination; The multiplier; Effect of fiscal policy in the Keynesian model.

Budgets of Bangladesh: The revenue at the capital budget; Income, expenditure of the government; direct and indirect taxes.

Development Planning in Bangladesh: Need for planning in Bangladesh; Various five year plans in Bangladesh; Development strategies in the five year plans of Bangladesh.

Text Book:

1. K. K. Dewett : **Modern Economic Theory**, *S. Chand Publishers*
2. H.L Ahuja : **Advanced Economic Theory**,*S. Chand Publishers*

Reference Books:

1. A. Asimakopulos : **An Introduction To Economic Theory:**Microeconomics,*Oxford University Press*
2. A. Koutsoyiannis : **Modern Microeconomics**, *Palgrave Macmillan*

STAT1211: Statistics for Engineers

Credits: 2 **Contact Hours:** 26
Year: First **Semester:** Even

Prerequisite: ICE 3261 : Communication Engineering
Motivation To know basic theory of statistics and its applicability in real world situations.

Course Objective:

This course aims introduce statistics and its applications for science and engineering student. The objective is intended for students to solve some practical by statistical methods. It will help students develop skills in thinking and analyzing problems from a probabilistic and statistical point of view.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the different terminologies related with the concepts of basic statistics, statistical distributions and probability.	P1	P2
CLO2	To **analyze**the real-life problems and use the acquired knowledge to solve it.	P2	
CLO3	To **choose** the appropriate probability models to describe real world situations.	P2	P3
CLO4	To **report** statistical results in a clear and coherent form.	P3	

Evaluation/ Assessment System: Students are evaluated out of total 50 **Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 2 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Descriptive statistical data: Meaning and scope of statistics, Sources and type of statistical data, Representation of statistical data, Location, Dispersion and their measures. Skewness, Kurtosis and their measures. Moment and Cumulants and Practical examples.

Probability: Concept of probability. Sample Space, Events union and Intersection of Events. Probability of events. Laws of probability, Conditional probabilities, Bayes' Theorem, Chebyshev's Inequality and Practical examples.

Random variables and probability Distribution: Basic concepts, Discrete and continuous random variables, Density and distributional functions, Mathematical expectation and variance, Joint marginal and conditional density functions, Conditional Expectation and conditional variance, Moments and Cumulant generating functions. Characteristic function. Study of Binomial, Poisson, Normal and Bivariate Normal distribution

and Practical examples.

Linear Regression and Correlation: Correlation, Rank correlation, Partial and Multiple correlations. Linear Regression for two variables. Principle of Least Squares Method. Lines of best fit Residual Analysis and examples.

Test of Significance: Basic ideas of Null hypothesis. Alternative hypothesis. Type-I error, Type-II error, level of significance, Degree of freedom, Rejection region and Acceptance region. Test of Single mean, Single variance, Two sample means and variances. Test for 2x2 contingency tables. Independence test and practical examples.

Text Book:

1. A. J. B. Anderson : **Interpreting Data**.*Chapman and Hall, London*
2. H. Cramer : **The Elements of Probability Theory**. *Wiley, N. Y*

Reference Book

1. P. Hoel, : **Introductory Statistics**, *Wiley and Sons, N. Y*.
2. D. V. Lindley : **Introduction to Probability and Statistics**. Vol-1 *C. U. P. London*
3. S. Lipschutz : **Probability**, *McGraw-Hill, N. Y.*
4. Mosteller, Rourke and Thomas : **Probability With Statistical Applications**, *Addison- Wesley*
5. F. L. Wolf : **Elements of Probability and Statistics**,*McGraw-Hill, N. Y.*
6. T. H. Wonnacot and R. J. Wonnacot : **Introductory Statistics**, *Wiley and Sons. N. Y.*
7. G. U. Yule, and M. G. Kendall : **An Introduction to the Theory of Statistics**, *Charles Griffin, London*

MATH1211: Differential and Integral Calculus

Credits: 3 **Contact Hours:** 39
Year: First **Semester:** Even

Prerequisite: MATH1111:Algebra, Trigonometry and Vector
Motivation Familiarize students with introductory calculus.

Course Objective:

The main objective of this course is to provide necessary background of differential and integral calculus. Different mathematical problems in this course will help building a comprehensive skill for analyzing and solving real life engineering problems.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the concept of a function, limits and continuity and solve the limiting value problem.	P1	P2
CLO2	To**Apply**different method of solving ordinary and partial differentiation.	P3	P4
CLO3	To **Calculate** the integral of definite and indefinite forms	P2	P3
CLO4	To the exact area under the curve of a function, knowing and being able to find the exact area between the curves of two functions.	P2	P3

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√				√	√
CLO2	√		√	√	√	√
CLO3		√		√	√	√
CLO4		√	√	√	√`	
CLO5			√			

Course Contents:

Functions: Domain, Range, Inverse function and graphs of functions, Composition of function, Limits, Continuity, Indeterminate form.

Ordinary Differentiation: Differentiability, Differentiation, Successive differentiation and Leibnitz theorem.

Expansions of functions: Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's formulae.

Maximum and minimum of functions of one variable.

Partial Differentiation: Euler's theorem, Tangents and normal. Asymptotes.

Indefinite Integrals: Method of substitution, Integration by parts, Special trigonometric functions and rational fractions.

Definite Integrals: Fundamental theorem, General properties, Evaluations of definite integrals and reduction formulas.

Multiple Integrals: Determination of lengths, Areas and Volumes.

Text Book:

1. B. C. Das and B.N.Mukherjee : **Differential Calculus**,*U. N. Dhur& Sons*
2. B. C. Das and B.N.Mukherjee : **Integral Calculus**, *U. N. Dhur& Sons*

Reference Books:

1. F. Ayres and Elliot Mendelson : **Calculas (Schaum's Outline Series)**,*McGraw-Hill*
2. Joseph Edwards : **Differential Calculas**,*Kessinger Publishing*
3. Md. Abdul Latif and S. Bhattacharjee : **Differential Calculus**, *Chandaapure, Chittagong*

PHY 1221:Applied Electricity and Magnetism

Credits: 3 **Contact Hours:** 42
Year: First **Semester:** Even

Prerequisite: None
Motivation To know basic Electrical and Magnetic laws required to understand computer hardware

Course Objective:
The aim of this course to provide the basic phenomena of electricity and magnetism as they relate to the basic operation of computer hardware and their design. The course will cover electrical filters circuits, the electrostatics, capacitance, inductance and thermoelectricity,

CLO (Course Learning Outcome			
CLOs	After successfully completing this course, students will be able	**CLO mapping**	
CLO1	To **identi**fy different types of electrical and magnetic phenomena		
CLO2	To **understa**nd the Gauss's Law; Kirchhoffs Law, Faraday's law; Ampere's law		
CLO3	To **construct** LC, LR, RC, LRC filter circuits		

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:
Electrostatics: Electric dipole; electric field due to a dipole; dipole on external electric field; Gauss's Law and its applications.

Capacitors: Parallel plate capacitors with dielectric; dielectrics and Gauss's Law; susceptibility, permeability, and dielectric constant; energy stored in an electric field. Electric Current: Electron theory of conductivity; conductor, semiconductors and insulators; superconductors, current and current density; Kirchhoffs Law and its applications.

Electomagnetic Induction: Faraday's experiment; Faraday's law; Ampere's law, motional e.m.f.; self and mutual inductance galvanometers-moving coil, ballistic and deadbeat types.

Thermoelectricity: Thermal e.m.f; Seebeck, Peltier and Thomson Effects; laws of addition of thermal e.m.f., thermoelectric power.

DC and AC Circuits: D.C. circuits with LR, RC, and LCR in series; A.C. circuits with LR, RC, LC, and LCR in series.

Text Book:
1. J David Halliday, Robert Resnick and Kenneth S. Krane : **Physics (Part-I & II),** *Wiley*
2. J David Halliday, Robert Resnick and Kenneth S. Krane : **Physics (Part-I & II),** *Wiley*

Reference Books:
1. Arthur Frederic Kip : **Fundamentals of Electricity and Magnetism**, *McGraw-Hill Inc.*
2. M. S. Huq : **Concepts of Electricity and Magnetism,***Students' Publications*

CSE 1211: Introduction to Digital Electronics

Credits: 3 **Contact Hours:** 39
Year: First **Semester:** Even

Prerequisite: EEE1131: Electrical Circuit and Electronics
Motivation To develop basics knowledge on Digital Electronics, Analog to Digital conversion
Course Objective:
This course will provide students with the knowledge required to understand and troubleshoot digital electronic circuits. Among the topics discussed are number systems, codes, logic gates, Boolean statements, combinational logic, flip-flops, counters, shift registers, memory and storage, and integrated circuit technologies.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **identi**fy the switching circuits, Boolean Algebra, 555 timer, A/D conversion	P1	P2
CLO2	To **understa**nd how to minimize a switching function,	P2	
CLO3	To **determine** the characteristics of switching devices, FFs and A/D conversion	P2	
CLO4	To **incorporate** 555 timer for different applications	P3	P5

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Fundamentals of Digital Logic System: Number Systems, weighted and non-weighted codes, error detection code, Binary addition and subtraction, 2's compliment methods.

Logic Gates and Boolean Algebra, Logic Circuit Design, Adder, Substractor, Minimization Techniques: Algebraic Simplification, Karnaugh Map Method, Quine-McCluskey method, Consensus method.

Switching Devices, switching characteristics of diodes, transistor and FETs. Integrated Circuit Logic Families: DTL & TTL logic family, standard TTL series characteristics, other TTL series, TTL loading rules, TTL open-collector outputs, tristate TTL. The ECL family. Digital MOSFET circuits, characteristics, CMOS circuits, CMOS tristate logic, TTL driving CMOS, CMOS driving TTL.

Flip-Flops (FF) and related devices: Transistor Latch, NAND gate latch, NOR gate latch, D latch. Clock signals and Clocked FFs: Clocked SR, JK and D Flip-Flops, Master/Slave JK FF, timing diagram of different FFs, Edge-triggered and level-triggered timing diagrams.

555 Timer: Architecture of 555 Timer, different application of 555 timer, 555 as monostable, bistable and astableMultivibrators
A/D And D/A Converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

Text Book:

1. Ronald J. Tocci : **Digital Systems: Principles and Applications,** *Prentice Hall*
2. V. K. Jain : **An Introduction to Switching Theory and Digital Electronics**, *Khanna Publishers, New Delhi*

Reference Books:

1. M. Morris Mano : **Digital Logic and Computer Design***, Prentice Hall*
2. William H. Gothmann : **Digital Electronics,***Prentice Hall*

CSE1212: Introduction to Digital Electronics Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE1211

CSE1221: Object Oriented Programming

Credits: 3 **Contact Hours:** 39
Year: First, **Semester:** Odd

Prerequisite: None
Motivation Introduce how to designa computer program by making them out of objects that interact with one another

Course Objective:
The main objective of this course is to provide necessary knowledge on integrated development environment (IDE), debugger, and code repository, how to develop Java application with graphical user interface (GUI)

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To u**se** programming tools such as an integrated development environment (IDE), debugger, and code repository.	P1	P2
CLO2	To **understand** java language elements and characteristics, including data types, operators, control structures and how to develop Java application.	P2	
CLO3	To **write** program using different OOP concepts, including objects, classes, methods, parameter passing, information hiding, inheritance and polymorphism are introduced and their implementations using Java.	P3	
CLO4	To **apply c**onsistent documentation and program style standards that contribute to the readability and maintainability of software.	P2	P3
CLO5	To **apply go**od programming style and understand the impact of style on developing and maintaining programs.	P2	P4

CLO6	To developing graphical user interface (GUI), and graphics in AWT, SWING and JavaFX.	P3	P6
CLO7	To **design, implement**, and use generic classes and methods, limitations of generic programming, i.e. type erasure. Students will also learn how to throw and handle exceptions for dealing with exceptional situations and errors. Students will design custom exception types.	P3	P4

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

- Java/JVM, Java Applications, Development Tools, Sample Program, Compilation, Java Primitive Data Types and Operations, Program Structures
- Variables, Constants Data Types & Type Conversions, Comments, Arithmetic/Relational Operators, Output and Formatting Output.
- Conditional IF Block, For, While Loops, Switch Selection Block, Unit Testing with Junit, Good design and programming practice, Simple UML class diagrams.
- Classes & Objects, Constructors, Properties & Access Specifiers, Java Class Library, Encapsulation, Object Parameters, The Object Class, Cloning Objects, Serialization of Objects, Inheritance, Polymorphism, Abstract Classes & Interfaces, Object-Oriented Design
- Defining Methods, Calling Methods, Parameter Values Scoping, Method Overloading, Method Overriding, Virtual Functions
- Creating Strings, String Operations & Methods, String Class, StringBuilder/StringBuffer Class, Character Class, Text I/O
- Array Basics, Array Parameters, Variable Length Array Parameters, Searching Arrays, Array Class, Multi-dimensional Arrays, ArrayLists
- Overview, Benefits, Exception Types Try....Catch.... Finally Block Throwing Exceptions, Assertions, Concurrency and Multi-threading, Synchronization of access to objects
- Collections & Generics, Generic Classes and Methods, Custom Generic Data Structures, Reflection and Generic Programming / Templates, Java SE 8 Lambdas and Streams, File Class, Reading & Writing Text Files
- Observer, Strategy, Composite, Decorator, Iterator, Adaptor, Command, Factory Method, Proxy, Singleton, and Visitor
- Overview & Java IDEs, Getting Started with GUI Programming, Creating User Interfaces, Swings vs AWT, Swing Controls, Event Driven Programming, Event Handling, Swing Models, Menus, Toolbars, Dialogs, Containers, Layout Managers, and Borders, JavaFX Graphical User Interface

Text Book:

1. Horstman, Cay. : **Big Java: Early Objects, 6th Edition,New York**: John Wiley & Sons, Inc.
2. Herbert Schildt : **Java: The Complete Reference, Ninth Edition 9th Edition**

Reference Books:

2. Deitel & Deitel : **Java: How to Program. 8th ed**

CSE1222: Object Oriented Programming Lab

50 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
2 Credit, 52 Contact hours

Laboratory works based on CSE1221

Part-II, Odd Semester

ACCO2111: Industrial Management and Accountancy

Credits: 2 **Contact Hours:** 26
Year: Second **Semester:** Odd

Prerequisite: None
Motivation To understand the role of management and accountancy in modern commercial realm.
Course Objective:
This course gives students a good understanding about the concept of management and accountancy. The objective of this course is to enhance a manager's ability to make effective economic decisions in the context of organizational growth and development. It also explains the accountancy which is concerned with keeping the business deals and transactions in order.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** different theories and their practices in the field of management and accountancy	P1	P2
CLO2	To **implement**anagreement control systems and responsibility accounting.	P3	P11
CLO3	To **analyze**projects using cash flow approach	P2	P3
CLO4	To **apply**the knowledge to deal with practical cases when necessary.	P6	P11

Evaluation/ Assessment System: Students are evaluated out of total **50 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√	√

Course Contents:

Industry: Commerce-Industry: Meaning & Characteristics of Industry, Types of Industry; Business: Meaning & Objectives of Business, Types of Business: Sole Proprietorship, Partnership, Joint Stock Company, State Enterprise and Cooperative Society.

Fundamentals of Management: Meaning of Management, Principles of Management, Functions of Management, Levels of Management, Roles of Management, Scientific Management and Core Management skills.

Factory Location and Plant Layout: Factors Determining Location of Factory, Steps in Location, Factors Influencing Layout, Types of Layout, Problems of Layout.

Work-Environment and Plant Utility: Meaning, Importance, Factors Affecting Work Environment, Plant Utility, Lighting, Ventilation, Air-conditioning, Sanitation and Noise Control.

Sole Proprietorships: Features, Advantages, Disadvantages of Sole Proprietorship, Sustainability of Sole proprietorships.

Man Power Planning & Motivation: Need, Objectives, Manpower Planning Process, Recruitment, Selection and Training, Issue in Managing People, Maslow's Need Hierarchy, Social Needs and Productivity, Hygiene and Motivators.

Conflict & Union Management Perspective: Meaning, Process of Conflict, Types of Conflict, Industrial Conflict Resolution Methods, Negotiation Skills, Growth of Trade Unions, Functions, Structure, Leadership and Management in the Trade Union, Collective Bargaining.

Accountings: History, Scope and Nature of Accounting, Purpose of Accounting, Information and Uses

Transaction: Meaning and Features, Accounting Equation, Meaning and Classification of Account, Double entry System, Rules for Determining Debit and Credit, Accounting cycle.

Journal, Ledger and Trial Balance: Meaning, Features, Necessity, Rules, Double and Triple Column Cash Book and Practical Problems.

Work Sheet: Meaning, Purpose, Adjustment Entries and 10 Columns Work Sheet.

Cost Terms Concepts and Classification: Meaning of Cost, Manufacturing and Non Manufacturing Costs, Period and Product Costs, Variable and Fixed Costs, Direct and Indirect Costs, Differential, Opportunity and Sunk Costs, Schedule of Cost of Goods Manufactured, Schedule of Cost of Goods Sold and Income Statement.

Cost-Volume-Profit Relationship: Contribution Margin and Ratio, Break-even Analysis, CVP relationship in Graphical Form and Target Net Profit Analysis.

Text Book:

1. M. C. Shukla : **Business Organization and Management**,*S. Chand Publisher.*

Reference Books:

1. Harold Koontz and Heinz Weihrich : **Management**, *Tata McGraw-Hill.*
2. Krajewski and Ritzman : **Operation Management**,*Addison-Wesley Publishing Company*
3. David A. Decenzo and Stephen P. Robbins : **Human Resource Management**, *John Wiley & Sons publisher.*
4. HermansonEtar : **Accounting Principles**, *Business Publications*
5. Ray H. Garrison : **Managerial Accounting**,*Irwin Professional Publishing*

STAT 2111: Theory of Statistics

Credits: 2 **Contact Hours:** 26
Year: Second **Semester:** Odd

Prerequisite: None
Motivation To introduce students with statistical and probabilistic study of real life problems.
Course Objective:
The main objectives of the course are to provide students with theoretical foundations and methods of theory of statistics,
to provide students with knowledge of typical statistical problems statement and mathematical methods for solving them, to develop practical skills of the statistical methods and theories application to real data sets.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** different theories of probability distribution.	P1	P2
CLO2	To u**nderstand** the methods of coefficient and error estimation.	P1	P2
CLO3	To d**emonstrate**knowledge of statistical theory and to solve the problems related with science and engineering.	P3	
CLO4	To **apply**theoretical and experimental research, including search and study of the scientific and technical information, mathematical modeling, ability to design and conduct experiments, as well as to analyze and interpret data.	P3	P4

Evaluation/ Assessment System: Students are evaluated out of total **50 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√`	√

Course Contents:

Sampling Distributing: Fisher's Lemma. Study of □ 2 Distribution, T-Distribution and F-Distribution, Properties, uses & Applications. Distribution of sample correlation coefficient in the null case. Sampling Distribution of the Medians and Range.

Elements of Point Estimations: Basic Concepts. Consistent estimates. Unbiased estimates. Mean and variance of estimates. Ideas of Efficiency. Principle of Maximum Likelihood. Illustration from Binomial, poission& Normal Distributions.

Test of Significance: Basic ideas of Null hypothesis. Alternative hypothesis. Type-I error, Type-II error, level of significance, Degree of freedom, Rejection region and Acceptance region. Test of Single mean, Single variance, Two sample means and variances. Test for 2x2 contingency tables. Independence test and practical examples.

Decision Rules: Statistical decisions; Statistical hypothesis; Critical region, Best critical region; Two types of errors; procedure of Test of hypothesis; Most powerful test, standard Errors.

Test of Significance: Test of single mean & single variance. Comparison of two sample Means, proportions and Variances. Bartlett's test for homogeniety of variances. Test for correlation and Regression coefficients. Exact test for 2*2 tables. Test for r*c tables. Three-Way contingency tables. Large Sample Test of Significance. Non-parametric Test, One Sample and two Sample Sign Test. Run Test and Rank Sum Test.

Text Book:

1. Mood, Graybill and Boes : **Introduction to the Theory of Statistics**, *McGraw-Hill, N. Y.*
2. R. L. Anderson, T. A. Bancroft : **Statistical Theory in Research**, *McGraw-Hill N. Y. Banctoft, T.*

Reference Books:

1. G. Beaumont : **Intermediate Mathematical Statistics**,*Chapman and Hill, London*
2. Gutman, Wilks and Hunter **Introductory Engineering Statistics**, *John Wiley and Sons.*
3. P. G. Hoel : **Introduction to Mathematical Statistics**,*John Wiley and Sons, N. Y.*
4. R. V. Hogg. and A. T. Graig : **Introduction to Mathematical Statistics**,*CollierMacmilan, N. LY.*
5. B. W. Lindgren : **Statistical Theory**,*Collier-Macmillan Co; N. Y.*
6. G. B. Weatheril : **Intermediate Statistics Methods**,*Chapman and Hall, London*

MATH2111: Matrices and Differential Equations

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Odd

Prerequisite: MATH1211: Differential and Integral Calculus
Motivation To understand the formation, solution and applications of differential equations.

Course Objective:

The main objective of this course is to provide necessary background of matrices and use of matrices to solve systems of linear equations. This course introduces the topic of differential equations: first order and second order and the way to solve the equation.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the concept of different matrices, its transformation and properties.	P1	P2
CLO2	To **calculate** the eigenvalue and eigenvector of a system using matrices.	P2	P5
CLO3	To **analyze** the different order differential equation and find the solution of the equation.	P2	P3
CLO4	To **apply** differential equation as a mean to explain and forecast physical system.	P5	P6

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time**is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√				√	√
CLO2	√		√	√	√	√
CLO3		√		√	√	√
CLO4		√	√	√	√`	

Course Contents:

Algebra of Matrices: Adjoint, Inverse and rank of matrix-definition, Properties and evaluation, Determinant Property and Crammer's Rule.

Elementary Transformations: Echelon: Canonical and normal forms, Solution of system of linear equations, Consistency and solution of homogeneous and nonhomogeneous systems by matrix method, and reduction to equivalent system.

Characteristic Equation: Eigenvalues, Eigenvectors and Caley-Hamilton theorem, Similar matrices and diagonalization.

Solutions of first order and first degree and first-order and higher degree equations with variable coefficients.

Solution of Higher-Order linear differential equations.

Differential Equations: Series solution of linear differential equation, Series solution of second order equation with variable coefficients, Solutions of partial differential equation, Laplace's equation and transformation, Poisson's equation, Helmholtz's equation, Diffusion equation, Green's function solution, Integral equation.

Text Book:

1. Shepley L. Ross : **Introduction to Ordinary Differential Equations**, *Wiley.*
2. M. L. Khanna **Matrices,***JaiPrakashNath and Co*

Reference Books:

1. Jr. Frank Ayres : **Theory and Problems of Matrices**, Schaum's Outline Series,*McGraw-Hill*
2. Frank Ayres : **Differential Equations***, McGraw-Hill*
3. B. D. Sharma : **Differential Equations***, KedarNath Ram Nath.*
4. Louis Albert Pipes : **Applied Mathematics for Engineers and Physicist**,*McGraw-Hill*

CSE 2111: Digital System Design

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Odd

Prerequisite: CSE1211: Introduction to Digital Electronics
Motivation To develop basics and design knowledge on Digital Systems
Course Objective: The Objective of this course is to familiarize the student with fundamental principles of digital design. It provides coverage of classical hardware design for both combinational and sequential logic circuits .This course will guide on how to develop and apply Verilog coding styles for synthesis and data-path structures.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **identi**fy the basics of Combinational and Sequential circuits, Boolean Algebra	P1	P2
CLO2	To **design** a Sequential/Conditional circuits, Counter, Register, Decoder, MUX, PLA	P3	P4
CLO3	To use HDL to simulate Sequential circuits, Counters, Registers	P3	P12

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	

Course Contents:

Combinational Logic: Code converters, advanced arithmetic circuits, carry-look-ahead adder, binary parallel adder, BCD adder. Magnitude comparator.

MSI logic circuits: Encoders, decoders, multiplexers, demultiplexers, application od decoder and multiplexer: realizing for min-terms and max-terms, Binary Multiplier Parity generator and checker. Sequential Circuits: Latches, flip flops (FF), analysis of clocked sequential circuits, state reduction and assignments.

Registers and Counters: Registers, shift registers, parallel loading of shift register, counters, synchronous and asynchronous counter, up and down counter, ripple counter, counters using SR and JK FF, design of sequential counter, application of counter: parallel to serial communication, other types of counters.

Memory and Programmable Logic: Random access memory (RAM), memory addressing, Programmable Array Logic (PAL), Programmable Logic Array (PLA), Introduction to CPLDs, FPGAs,

Introduction to hardware description language (HDL), Verilog HDL/VHDL, Syntax and program structure of HDL (Verilog HDL/VHDL). Application of HDL: Description and simulation of common combinational circuits using HDL: Adder, decoder, multiplexer etc. Description and simulation of sequential circuits, registers, counters.

Text Book:

1. Ronald J. Tocci : **Digital Systems: Principles and Applications,** *Prentice Hall*
2. M. Morris Mano : **Digital Logic and Computer Design***, Prentice Hall*

Reference Books:

1. V. K. Jain : **An Introduction to Switching Theory and Digital Electronics**, *Khanna Publishers, New Delhi*
2. William H. Gothmann : **Digital Electronics,***Prentice Hall*

CSE2112: Digital System Design Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE2111

CSE 2121: Data Structure

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Odd

Prerequisite: CSE1121: Computer Programming with C
Motivation To learn all accumulated expertise in computing and use them in data storage and access so as to write cleaner code that run much faster.

Course Objective:

The main objective of this course is to provide necessary knowledge on different data structures and efficient storage mechanisms of data for an easy access. Data structures make the program easier to understand and debug. It also introducevarious techniques for representation of the data in the real world.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand**data structures, its types, and applications of different data structures.	P1	P2
CLO2	To **compare**the benefits of dynamic and static data structures implementations.	P5	
CLO3	To **evaluate** algorithms and data structures in terms of time and memory complexity of basic operations.	P6	
CLO4	To **formulate** new solutions for programing problems using learned algorithms and data structures	P6	P12

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Arrays: Maximization, ordered lists, sparse matrices, representation of arrays.

Stacks, Queues and Recursion: Different types of stacks and queues: Circular, dequeues, etc; evaluation of expressions, multiple stacks and queues;

Recursion: Direct and indirect recursion, depth of recursion; Simulation of Recursion, Removal of recursion; Towers of Hanoi.

Links Lists: singly linked lists, linked stacks and queues, the storage pool, polynomial addition, equivalence relations, sparse matrices, doubly linked lists and dynamic storage management, generalized lists, garbage collection and compaction.

Trees: Basic terminology, binary trees, binary tree representations, binary tree traversal; Extended binary trees: 2-trees, internal and external path lengths, Huffman codes/algorithms; threaded binary trees, binary tree representation of trees; Application of Trees: Set representation, decision trees, games trees: Counting binary trees.

Graphs: Introduction, definitions and terminology, graph representations, traversals, connected components and spanning trees, shortest path and transitive closure, activity networks, topological sort and critical paths, enumerating all paths.

Symbol Tables: static tree tables, dynamic tree tables; Hash Tables: Hashing functions overflow handling, theoretical evaluation of overflow techniques.

Files: file, queries and sequential organizations: Indexing Techniques: Cylinder-surface indexing hashed indexes, tree indexing-B-trees; Tree indexing.

Text Book:

1. Seymour Lipshultz : **Data Structures (Schaum's Outline Series)**,*Tata McGraw-Hill*
2. E. Horowitz and S. Sahni : **Fundamentals of Data Structures**,*Galgotia*.

Reference Books:

1. Edward M. Reingold&Wilfred J. Hansen : **Data Structures**,*Addison Wesley Publishers*
2. Robert L. Kruse : **Data Structures and Program Design**, *Prentice Hall*

CSE2122: Data Structure Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE2211

MATH2131: Discrete Mathematics

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Odd

Prerequisite: None.
Motivation To know the foundational mathematical concepts at the core of computer science.
Course Objective:
The main objective of this course is to acquire knowledge of techniques to understand, explain, and apply the foundational mathematical concepts that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. The skills, students learn in this course are essential for later courses where they will be used to reason about and develop algorithms, prove properties about programs, and understand the limits of different models of computation. To achieve these objectives students will learn logic and proof, sets, functions, as well as algorithms and mathematical reasoning. Key topics involving relations, graphs, trees, and formal languages and computability are covered in this course.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** definitions and diagram strategies for potential proofs in logical sequential order without mathematical symbols (plain English) and the operations on discrete structures such as sets, functions, relations or sequences.	P1	P2
CLO2	To **construct** mathematical arguments using logical connectives and quantifiers proofs using direct proof, proof by contradiction, and proof by cases, or mathematical induction.	P2	P3
CLO3	To **describe** essential concepts in graph theory and related algorithms	P3	P4
CLO4	To **analyze** and solve problems involving recurrence relations and generating functions.	P2	P3
CLO5	To **apply** algorithms and use definitions to solve problems to proof statements in elementary number theory.	P5	P6
CLO6	To **apply** knowledge about discrete mathematics in problem solving.	P5	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time**is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√		√	√	√
CLO4		√	√		√`	
CLO5		√	√	√	√	
CLO6			√		√	

Course Contents:

Mathematical Logic: Connectives, normal Forms, theory of inference for proposition calculus, predicate calculus, inference theory of predicate calculus, method of proof, mathematical induction.

Sets: Basic concept of set theory, operation of sets, ordered pairs and n-tuples.

Relation and ordering: Relations, properties of Binary relation in a set, composition of binary relation,

relation matrix and graph of a relation, partial ordering, path in relation and di-graph.

Functions: definition, composition of function, inverse function, binary and array operation.

Graph: Introduction to graph, graph terminology, representing graph and graph isomorphism, paths, reachability, connectivity, Euler and Hamilton path, shortest path problems, graph colouring, matrix representation of graph.

Trees: Introduction of trees, application of trees, tree traversal, labelling trees, trees and sorting, spanning trees, minimal spanning tree, undirected trees.

Algebraic structure: Algebraic system, general properties, some simple algebraic system.

Text Book:

1. Kenneth H. Rosen : **Discrete Mathematics and Its Applications**, *McGraw-Hill*

Reference Books:

1. J. P. Tremblay and R. Manohar : **Discrete Mathematics structures with applications to Computer Science***, McGraw-Hill*
2. Seymour Lipschutz : **Theory and Problems of Discrete Mathematics**,Schaum's Outline Series,*McGraw-Hill*
3. Bernard Kolman, Robert Busby, Sharon C. Ross : **Discrete Mathematical Structures**, *Prentice Hall*
4. C.L. Liu : **Elements of Discrete Mathematics**, *McGraw-Hill.*

CSE2142: Software Development Lab I

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Part-II, Even Semester

LAW 2211: Cyber and Intellectual Property Law

Credits: 2 **Contact Hours:** 26
Year: Second **Semester:** Even

Prerequisite: None

Motivation To provide a deep understanding of cyber law concepts and while explaining intellectual property concepts, making students aware of their rights for the protection of their invention done.

Course Objective:

This course aims to understand the different theoretical and cross-disciplinary approaches related to cyber-security and the regulations of the Internet. Also to make the students knowledgeable about the current ICT policy and law of Bangladesh, as well as International cyber law. This course also intends to teach students Intellectual property concept and fundamental knowledge of patents, copyrights, trademarks, designs and Information Technology Act. Students also get awareness of importance of acquiring the patent and copyright for their innovative works and get the knowledge of plagiarism in their innovations which can be questioned legally.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **describe** laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security.	P1	
CLO2	To **discuss** different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.	P2	
CLO3	To **identify** intellectual property right issues in the cyberspace and design strategies to protect your intellectual property.	P4	P5
CLO4	To **recognize** the importance of digital evidence in prosecution and compare laws of different countries for handling evidence.	P5	P6
CLO5	To **assess** the legal issues with online trading, and analyze applicable e-contracting and taxation regulations.	P5	P6

Evaluation/ Assessment System: Students will be evaluated out of total **50 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√			√	√	√
CLO3	√			√	√	√
CLO4		√	√		√`	√
CLO5		√	√		√	√

Course Contents:

Cyber Law

Cyber Law: Definition Nature, Scope, Utility of Cyber Law, Origin and Development of Cyber Law and Internet

ICT Policy in Bangladesh; Internet Service Providers (ISP)- Domain Name, Present Legal Basis of ISP in Bangladesh; e-Readiness in Bangladesh- e-Commerce in Bangladesh, e-Governance in Bangladesh, e-Learning/Education in Bangladesh, e-Journal in Bangladesh, e-Voting in Bangladesh; Electronic Evidence-Digital Signature, The Evidence Act of 1872 Vs. ICT Act-2006, Electronic Evidence in Bangladesh, Legal Effects of Electronic Evidence, UNCITRAL Model Law on Electronic Evidence;

Cyber Crime: Jurisdiction and Cyber Crime, Criminal Justice in Bangladesh and Implications on Cyber Crime; Cyber vandalism, Hacking, Malicious Spreading in Viruses, Password fraud, Cheating, Cyber

Pornography, Child Pornography, Protection of Copyrights and Intellectual Property right. Invasion of Privacy, Constitutional basis of Privacy, Unsolicited e-Mail, Defamation, Harassment and e-Mail Abuse, Present Legal Protection;

Human Rights Violation and Internet; The Information and Communication Technology Act, 2006- Objectives, Strengths & Weaknesses of the ICT Law, Regulation of Cryptography;

International Cyber Law- India, Sri Lanka, Japan, Malaysia, Australia and the USA, International Conventions on Cyber Law & Crime
Electronic Commerce- Electronic Money, Online Credit card Payments and Electronic Bills of Lading, UNCITRAL Model Law on Electronic Commerce.

Intellectual Property Law

Intellectual Property Law: Basic Concepts of IP Law, Nature of IPR, Computer-related intellectual property rights; Copyright- Original and development of copyright law, subject matter of copyright protection, Rights protected by copyright, Neighboring rights, Limitations of Copyright protecting, Piracy and infringement, Remedies, Computer Program, New technology and copyright, Software Patents Vs. Copyright, International Convention on Copyright

Patent- Patents and technological development, Requirements for patentability and ownership of patents, Scope of exclusive rights and duration of protection, Patents infringement, defenses and remedies, Legal arrangement for the transfer of technology, Types of intellectual Property licenses

Trademarks- Reasons for the protection of trademarks, Acquisition of trademark right, Registration procedure, Duration of protection and renewal, Termination, Trademarks in Cyberspace; Domain Name and Meta-tag Controversies.

Text Book:

1. VivckSood : **Cyber Law Simplified**,*Tata McGraw Hill Publications.*

Reference Books:

1. V. D. Dudej : **Information Technology & Cyber Laws**, *Commonwealth Publishers.*
2. Arpad Bogsch : **Universal Copyright Convention: An Analysis and Commentary**, *Bowker*
3. Alan Daubeny Russell Clarke : **Copyright in Industrial Designs**, *Sweet and M.*

MATH2231: Numerical Methods

Credits: 2 **Contact Hours:** 26
Year: Second **Semester:** Even

Prerequisite: CSE1121: Computer Programming with C
Motivation To know the story of how functions, derivatives, integrals, and differential equations are handled as strings of numbers in the computer.

Course Objective:
This course provides a foundation in some fundamental numerical methods for problem solving in a scientific computing environment. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems such as findings roots of the linear and non-linear equations, approximation and interpolation data, solving the problem involving integration and differentiations etc. on the computer.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	**To understand** numerical error in computational analysis, rates of convergence of algorithms, and identify known difficulties associated with classical computational algorithms.	P1	P2
CLO2	To **estimate** the approximation and interpolation of the data and functions and work with fundamental concepts in approximation.	P1	P2
CLO3	To **solve** systems of linear equations numerically and solve nonlinear systems.	P2	P3
CLO4	To **distinguish** between iterative and direct methods of solution for linear and nonlinear equations.	P6	
CLO5	To analyze and solve problems involving numerical integration and differentiation.	P3	
CLO6	To **construct** numerical solutions to problems and analyze the results.	P5	

Evaluation/ Assessment System: Students are evaluated out of total **50 Marks**. There are different types of assessment tools. In **the final written** examination, total time**is2 hours** where students should answer Four questions from two sections out of Six taking not more than Two from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√	√
CLO5		√	√	√	√	√
CLO6			√		√	

Course Contents:

Approximations and Errors: Accuracy and Precision, Error Definitions, Round-Off Errors, Truncation Errors.

Roots of Equations: Graphical Methods, The Bisection Method, The False-Position Method, Simple One-Point Iteration, The Newton-Raphson Method, The Secant Method.

Systems of linear algebraic equations: Gauss Elimination, Solving Small Numbers of Equations, Naive Gauss Elimination, Pitfalls of Elimination Methods, Matrix Inversion and Gauss –Seidel, The Matrix Inverse, Error Analysis and System Condition.

Curve Fitting: Linear Regression, Polynomial Regression, Multiple Linear Regression, Newton's Divided-Difference Interpolating Polynomials, Lagrange Interpolating Polynomials, Coefficients of an Interpolating Polynomials, Curve Fitting with sinusoidal Functions.

Numerical Differentiation and Integration : The Trapezoidal Rule, Simpson's Rules, Integration with Unequal Segments, Romberg Integration, Gauss Quadrature, High-Accuracy Differentiation Formulas, Richardson Extrapolation, Derivatives of Unequally Spaced Data.

Pseudorandom-number generators, the FFT.

Text Book:

1. Steven C. Chapra, Raymond P. Canale : **Numerical Methods for Engineers**, *McGraw-Hill*

Reference Books:

1. S. S. Kuo : **Computer Applications of Numerical Methods***, Addison-Wesley*
2. S. S. Sastry : **Introductory Methods of Numerical Analysis** *Prentice-Hall of India Pvt. Ltd.*
3. Press, Teukolsky, Vetterling and Flannery : **Numerical Recipes in C**: The Art of Scientific Computing,CambridgeUniversity Press.

CSE2232: Numerical Methods Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE2231

MATH2241: Linear Algebra

Credits: 3 **Contact Hours:** 39
Year: Second Semester: Even

Prerequisite: MATH1111: Algebra, Trigonometry and Vector, STAT1211: Statistics for Engineers

Motivation To develop a mathematical base for signal processing and machine learning

Course Objective:

The main objective of this course is to provide necessary knowledge on linear equations, matrix algebra, vector spaces, linear algebra concepts to model, solve, and analyze real-world situations.

CLO (Course Learning Outcome):			
CLOs	To **use** computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.	**PLO mapping**	
CLO1	To i**dentify** linear transformations of finite dimensional vector spaces and compose their matrices in specific bases.	P1	
CLO2	To **use** visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in R^2 and R^3, as well as conceptually extend these results to higher dimensions.	P2	
CLO3	To **construc**t mathematical expressions that involve vectors, matrices, and linear systems of linear equations.	P3	
CLO4	To **evaluate** mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.	P4	
CLO5	To critically **analyze a**nd construct mathematical arguments that relate to the study of introductory linear algebra.	P2	
CLO6	Apply linear algebra concepts to model, solve, and analyze real-world situations.	P3	
CLO7	Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.	P3	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

Vector space, subspace, sum and direct sum, Hilbert space, normed space, Banach space.

Linear dependence and independence basis and dimension.

Linear transformation: range, kernel, nullity, rank, singular and non-singular transformations.

Matrices and linear operators: Matrix representation of a linear operator. Change of basis, similarity, Matrices and linear mapping.

Characteristic roots and vectors of linear transformations, theorems and problems; characteristic and minimum polynomials of square matrices.

Linear functionals and dual vector spaces, Annihilators.

Norms and inner products, Orthogonal complements, orthonormals sets, Gram-schmidtorthogonalization process.

Text Book:

1. Seymour Lipschutz, Marc Lipson : **Linear Algebra,Schaum's Outline Series**, *McGraw-Hill*
2. I. N. Herstein : **Topics in Algebra,***Wiley*

CSE 2211: Theory of computation

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Even

Prerequisite: None
Motivation To know basic of computer network, its different protocol, network designing issues
Course Objective:
The main objective of this course is to provide several formal mathematical models of computation along with their relationships with formal languages. In particular, student will learn regular languages and context free languages which are crucial to understand how compilers and programming languages are built. Also, students will learn that not all problems are solvable by computers, and some problems do not admit efficient algorithms. Throughout this course, students will strengthen their rigorous mathematical reasoning skills.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **demonstrate** advanced knowledge of formal computation and its relationship to languages.	P1	
CLO2	To **apply** rigorously formal mathematical methods to prove properties of languages, grammars and automata.	P3	
CLO3	To **analyze** and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.	P4	P5
CLO4	To **compare** the characteristics of different types of computational models.	P12	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time**is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction: Logic and Proofs, Mathematical Inductions, Sets, Equivalence relations, Language and recursive definitions.

Languages and Grammars: Finite Automata - accepting languages, strings, string search algorithm, distinguishing strings, integers, lexical analysis, decision problems and languages, minimizing finite automata.

Regular languages and expression: Non-deterministic finite automata, Kleene's theorem. Context-free languages, regular languages and grammars.Simplified forms and normal forms.Push-Down Automata-deterministic PDA and non-deterministic PDA, top-down and bottom-up PDA, Parsing - top down and bottom-up parsers.Decision problems and CFL.

Computational Models: Computational tasks - search and decision problems, General model of computation, Turing Machines - definition of Turing machine, Turing machine and regular languages,

computing partial functions with Turing machine, composite and multi-tape Turing machines, non-deterministic Turing machines, universal Turing machine. Boolean circuits.Parallel random access machines.

Decision problems: Undecidable problems, reduction and halting problem, undecidable problems and context-free languages. Decision trees.Satisfiability problem.

Computational complexity: Introduction to complexity theory, Time complexity of a Turing machine, Polynomial-time reductions and NP completeness, NP-hard and NP-complete languages, the Cook-Levin theorem. Space complexity - time vs. space, logarithmic space, non-deterministic space complexity.Communication complexity.

Text Book:

1. John C. Martin : **Introduction to Languages and The Theory of Computation**. McGraw Hill 2011.
2. SanjeevArora and Boaz Barak : **Computational Complexity**: A Modern Approach

Reference Books:

1. OdedGoldreich : **Complexity of Algorithms** - A Conceptual Perspective
2. Peter Gacs and Laszlo Lovasz : **Complexity Algorithms**

CSE2221: Design and Analysis of Algorithms

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Even

Prerequisite: CSE2121: Data Structure, CSE1121: Structural Programming Language

Motivation : This course aims to introduce the classic algorithms in various domains, and techniques for designing efficient algorithms.

Course Objective:

The main objective of this course is to provide necessary knowledge on major modern algorithms, analyze efficient algorithms, algorithm design principles and complexity of algorithms.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **describe** the major modern algorithms and selected techniques that are essential to today's computers.	P2	
CLO2	To **decide o**n the suitability of a specific algorithm design technique for a given problem.	P3	
CLO3	To **apply t**he algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions;	P4	
CLO4	To **decide** on the suitability of a specific algorithm design technique for a given problem	P4	
CLO5	Tp**design a**nd analyze efficient algorithms using standard algorithm design technique for real world problems	P3	
CLO6	To **apply d**esign principles and concepts to algorithm design	P3	P4
CLO7	Analyze the complexity of algorithms	P2	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√

CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

Basics of Algorithm: Algorithms as a technology, Analyzing algorithms, Designing algorithms, Time and space analysis of algorithms, Average, best and worst case analysis, different notations.

Sorting: Insertion sort,Heapsort, Quicksort, Counting sort, Radix sort, Bucket sort.

Dynamic programming: Assembly-line scheduling, Matrix-chain multiplication, Longest common subsequence, Optimal binary search trees.

Greedy method: An activity-selection problem, Elements of the greedy strategy, Huffman codes.

Graph algorithms: Depth-first search, Breadth-first search, Topological sort, Minimum spanning tree, Kruskal's and Prim's algorithm, Bellman-Ford algorithm, Dijkstra's algorithm, Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs, Ford-Fulkerson method.

Computational Geometry: Line-segment properties, Determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points.

Backtracking: 8 queens problem, Sum of subsets, Graph coloring problem, Hamilton cycles.

Branch and bound: Lest cost search, 15-puzzle problem, Knapsack problem, Traveling salesman problem.

NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-complete problems.

Text Book:

1. Thomas H. Kormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein : **Introduction to Algorithms**, The MIT Press
2. D. E. Knuth : **The Art of Computer Programming**, Vol. 1, 2, 3, Addison-Wesley.

Reference Books:

3. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran : **Fundamentals of Computer Algorithms**, *Galgotia Publications*

CSE2222: Design and Analysis of Algorithms Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE2221

CSE 2231: Computer Architecture and Organization

Credits: 3 **Contact Hours:** 39
Year: Second **Semester:** Even

Prerequisite: APEE1131: Electrical Circuit and Electronics, CSE2111: Digital System Design
Motivation To develop basics and design knowledge on Computer Architecture and Systems
Course Objective: To provide students with a fundamental understanding of the functional components of a computer system, and how they are organised. The emphasis of the module is on the hardware aspects of a system, and how hardware is used during the execution of software. This is a core component of all computer science related degree courses. Practical skills will also be developed in the use and construction of computer components, and their interfacing to microprocessors.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To provide **knowledge** on basic of Computer Architecture and its organization	P1	P2
CLO2	To **understand** how Computer Systems works, its design objectives	P3	P4

CLO3	To **show** thedesigning procedure of a processor, memory and storage	P6	P12

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	

Course Contents:

Concepts and Terminology: Digital computer components Hardware & Software and their dual nature, recent development, Role of Operating Systems (OS).

Processor Design: Introduction: Processor organization, information representation, number formats; Fixed Point Arithmetic: Addition, subtraction, multiplication, division; ALU Design: Basic ALU organization, floating point arithmetic.
Control Design: Hardwired control: Design methods, multiplier control unit, CPU control unit; Basic concept of Micro programmed Control, Control memory optimization.

Memory Devices and its Organization: Different types of semiconductor memory, magnetic memory, optical memory, virtual memory, memory hierarchies; High-speed Memories: Interleaved memories, caches, associative memories. System Organization: Communications: Introduction, bus control; IO Systems: Programmed IO, DMA and interrupts, IO processors.

Application HDL for microcomputer design: Description of Adder, ALU by using HDL, implementation of a simple microcomputer system using HDL.

Text Book:

1. John P. Hayes : **Computer Architecture and Organization**, *McGraw-Hill.*
   M. Morris Mano : **Computer Architecture,***Prentice Hall.*

Reference Books:

1. Kai Hwang and Faye A. Briggs : **Computer Architecture and Parallel Processing**, *McGraw-Hill.*
2. William Stallings : **Computer Organization and Architecture: Designing for Performance**, *Prentice Hall.*

CSE2232: Computer Architecture and Organization Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE2231

CSE2242: Technical Writing and Presentation

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

CSE2252: Software Development Lab II

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 credits, 26 Contact hours

Part-III, Odd Semester

CSE 3111: System Analysis and Design

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite: None
Motivation To study how organizations, use computer systems and design solutions to help them operate more efficiently and effectively.

Course Objective:
The main objective of the course is to provide the students an overview of the principles, methods and techniques of systems development. To make students knowledgeable of the process of planning a new system or replacing an existing system by defining its components or modules to satisfy the specific requirements. Also explain the students the concept that before planning, they need to understand the old system thoroughly and determine how computers can best be used to improve the system and ensure that all the components of the system work efficiently to accomplish their purpose.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **define** system, system analysis and other system concepts.	P1	
CLO2	To **explain** the system development life cycle.	P1	P2
CLO3	To **demonstrate** the process and stages of system design.	P1	P2
CLO4	To **distinguish** why a system fails or succeeds.	P4	
CLO5	To **evaluate** if an old system is needed to be replaced and a new system is needed to be designed.	P5	P6
CLO6	To **design** a new system.	P9	P11

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours**where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√			√	√	√
CLO3		√		√	√	√
CLO4		√			√	√
CLO5			√		√	√
CLO6			√		√	√

Course Contents:

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, the role of the systems analysis.

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

Systems Design: The process and stages of systems design, input/output and forms design, file organization and data base 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 study: Case studies of various information systems such as: Library management system, inventory system, voter identity management system, payroll system, etc.

Text Book:

1. E.M. Awad : **System Analysis and Design**, *Galgotia Publication Ltd*
2. P. Edwards : **System Analysis &Design**,*McGraw-Hill*

Reference Books:

1. A. Daniels and D. Yeates : **Basic System Analysis**, *Galgottia*

CSE 3121: Database Management System

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite: CSE2131: Discrete Mathematics

Motivation To know basic of database design and implementation, database security, integrity and concurrency.

Course Objective:

The main objective of this course is to provides a solidtechnical overview of database management systems, using a currentdatabase product as a case study. In addition to technical concerns,more general issues are emphasized. These include data independence,integrity, security, recovery, performance, database design principles,and database administration.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand**DBMS types, SQL data definition and SQL query languages.	P1	P2
CLO2	To c**onstruct**E-R diagram of a database application scenarios, convert into relational tables, normalize, populate and formulate SQL queries on the data.	P3	P5
CLO3	To **criticize** a database design and improve the design by normalization.	P4	P6
CLO4	To **design** and **build** a GUI application using a 4GL.	P3	P12

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with COs-Assessment Mapping is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information, Retrieval, Specialty Databases, Database Users and Administrators.

Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema, Diagrams, Relational Query Languages, Relational Operations.

Introduction to SQL: Overview of the SQL Query, Language, SQL Data Definition, Basic Structure of SQL, Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database.

Intermediate SQL: Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization.

Advanced SQL: Accessing SQL From a Programming, Language, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features, OLAP.

Formal Relational Query Languages: The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus.

Database Design and the E-R Model: Overview of the Design Process, Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling, Data, Other Aspects of Database Design.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database-Design Process, Modeling Temporal Data, Multivalued Dependencies, Domain-Key Normal Form.

Text Book:

1. A. Silberschatz : **Database System Concepts**,*McGraw-Hill.*
2. James Martin : **Principles of Database Management**, *Prentice-hall Of India Pvt Ltd*

Reference Books:

1. Ullman : **Database Management systems**, *Prentice-Hall Publication.*
2. Abey : **Oracle 8i a Beginners Guide**, *McGraw Hill.*

CSE3122: Database Management Systems Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3121

CSE 3131:Digital Signal Processing

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite MATH 2241: Linear Algebra
Motivation To know basic of the digital signal processing concepts and its analysis
Course Objective: This course is designed to provide students with a comprehensive treatment of the important issues in design, implementation and applications of digital signal processing concepts and algorithms. The course will cove r some traditional topics such as transforms and filter design including DFT, FFT, Z-transform.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** digital signals in time and frequency domain	P1	P2
CLO2	To **apply** different transforms on digital signals	P3	
CLO3	To **analyze** different characteristic of digital signal in frequency domain	P6	
CLO4	To **construct** different types of digital filter	P12	

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	

Course Contents:

Introduction: signals, systems and signal processing, classification of signals, the concept of frequency in continuous time and discrete time signals, analog to digital and digital to analog conversion, Sampling and quantization.

Discrete time signals and systems: Discrete time signals, discrete time systems, analysis of discrete time linear time invariant systems. Discrete time systems described by difference equations, implementation of discrete time systems, correlation and convolution of discrete time signals.

The z-transform: Introduction, definition of the z-transform, z-transform and ROC of infinite duration sequence, properties of z-transform inversion of the z-transform, the one-sided z-transform.

Frequency analysis of signals and systems: Frequency analysis of continuous time signals, Frequency analysis of discrete time signals, Properties of Fourier transform of discrete time signals, Frequency domain characteristics of linear time invariant system, linear time invariant systems as frequency selective filters, Inverse systems and deconvolution.

The Discrete Fourier Transform: The DFT, Properties of the DFT, Filtering method based on the DFT, Frequency analysis of signals using the DFT. Fast Fourier Transform Algorithms: FFT algorithms, applications of FFT algorithm. Digital Filters: Design of FIR and IIR filters.

Adaptive filters: Adaptive system, kalman filters, RLS adaptive filters, the steepest-descent method, the LMS filters.

Application of DSP: Speech processing, analysis and coding, Matlab application to DSP.

Text Book:

1. J. G. Prokis : **Digital Signal Processing**, *Prentice-hall Of India*
2. R. G. Lyon : **Understanding Digital Signal Processing,***Orling Kindersley India*

Reference Books:

1. Defatta : **Digital Signal Processing,***Wiley India Pvt Ltd*
2. P. R. Babu. : **Digital Signal Processing**, *Scitech Publication..*

CSE3132: Digital Signal Processing Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3131

CSE 3141: Compiler Design

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite: CSE2211: Theory of Computation
Motivation To know basic structure of compiler and design of phases of compiler such as lexical analyzer, parser etc.

Course Objective:

The main objective of this course is to make the student to understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler, understand what is syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers, understand the syntax analysis and, intermediate code generation,the role of symbol table and its organization, code generation, machine independent code optimization and instruction scheduling.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the role of a parser in a compiler and relate the yield of a parse tree to a grammar derivation.	P1	P2
CLO2	To **apply** an algorithm for a top-down or a bottom-up parser construction.	P3	
CLO3	To **analyze** and compare various compilers to select optimum.	P4	
CLO4	To **design** and **implement** an intermediate code generator based on given code patterns.	P12	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction: Introduction to compiler, compiler and translator, the structure of a compiler.

Grammars: Notation and concepts for languages and Grammars, sets and string, Discussion and classification of Grammars, Scanner regular expression, regular definition, finite automata, LL and LR Grammars, ambiguous grammar.

Parsing: Basic parsing technique, parsers, shift reduce parsing, operator-procedure parsing, top-down parsing, bottom up parsing, predictive parsing.

Syntax: Syntax directed translation, intermediate code generation, polish notation, parse tree and syntax trees, quadruples, triples, Boolean expression.

Symbol Table: Perspective and motivation of symbol table. Symbol table content, operation on symbol table, organization of symbol table.

Code Optimization: Code optimization, sources of optimization, basic blocks, folding, loop optimization, flowgraph, induction variable elimination, reduction in strength, code motion.

Error Handling: Compile time error handling, error detection, error recovery, error repair.

Coding: Code generation, object programs, problems in code generation, a machine model, a simple code generator, register allocation and assignment peephole optimization.

Text Book:

1. Alfred V. Aho and Jeffrey D. Ullman : **Principles of Compiler Design**, *Addison-Wesley Publication*.
2. A.J. Holub : **Compiler design in C**, *Prentice-Hall of India*

Reference Books:

1. Trembly and Sorensen : **Theory and Practices of Compiler Writing**,*McGraw-Hill computer science series.*
2. Hopcroft and Ulman : **Introduction to Automata Theory, Languages and Computation**, *University of Toronto*

CSE3142: Compiler Design Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3141

CSE 3151: Computer Network

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite: ICE 3261 : Communication Engineering
Motivation To know basic of computer network, its different protocol, network designing issues
Course Objective:
The main objective of this course is to provide necessary knowledge on computer network and its technical details so that the students can understand the data transmission technology through computer

network, network media, network protocols used in different layer of a network, routing issues etc. Therefore, students will get technically skilled on how to consider thetechnical issues in designing a computer network and how to configure network devices as per requirements.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** network types, its topology, different protocols, IEEE standards	P1	P2
CLO2	To **choose** media type, protocol necessary, topology required for a practical use	P2	
CLO3	To **design** LAN for real world application and to configure network devices	P3	P5
CLO4	To **compare** different types of computer network from technical viewpoint	P6	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction: Computer Networks and Applications, OSI reference model, TCP/IP model and terminology, Connectionless and Connection Oriented services, Service primitives, The ARPANET

Physical Layer: Circuit switching and Packet switching, X-25 protocol, Frame relay and Cell relay, ATM reference model. Medium Access Sublayer: Pure and slotted ALOHA, Persistent and Non persistent CSMA, CSMA with collision detection and collision free protocols, IEEE standard 802.3 and Ethernet.

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

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

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

Presentation Layer: Data Compression techniques, Frequency Dependent Coding, Context Dependent Encoding. Application Layer: Internet and intranets, Internet services and goals, DNS, SMTP, FTP, Telnet, HTTP, World Wide Web (WWW), DHCP and BOOTP., Designing LAN, FTP server, E-mail server, web server

Text Book:

1. Behrouz A. Forouzan : **TCP/IP Protocol Suite**, *McGraw-Hill*
2. Andrew S. Tanenbaum : **Computer Networks**, *Prentice Hall*

Reference Books:

1. William Stallings : **Data and Computer Communications**, *Prentice Hall*
2. Behrouz A. Forouzan : **Data Communications and Networking**, *McGraw-Hill*

CSE3152: Computer Networks Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3151

CSE3162: Software Development Lab II

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 credits, 26 Contact hours

Part-III, Even Semester

CSE3211: Software Engineering

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Even

Prerequisite: Object Oriented Programming Language, Data Structure, Algorithm
Motivation : To learn every aspects of software development life cycle from the requirements to the final product.
Course Objective: The main objective of this course is to provide necessary knowledge on object-oriented approach to software development, software life cycle model, UML, and software testing.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the basics of an object-oriented approach to software development, role of modeling, risk and quality	P1	
CLO2	To **analyze th**e correctness of a simple program fragment given a logical description of its required behavior.	P2	
CLO3	To **apply t**heir knowledge of testing principles to select appropriate test data for an individual software routine.	P3	
CLO4	To **Identify** economic implications of the software life cycle to the process of software construction	P3	
CLO5	To **employ** group working skills including general organization, planning and time management and inter-group negotiation.	P9	
CLO6	To make effective **use** of UML, along with design strategies such as defining a software architecture, separation of concerns and design patterns.	P11	
CLO7	To **formulate a** testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing.	P5	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

Introduction: Introduction to software engineering, Importance of software, The Software evolution, Software characteristics, Software components, Software applications, Crisis-Problem and causes.

Software development life-cycle: Requirement analysis, software design, coding, testing and maintenance etc.

Software requirement Specification: Water fall model, prototyping interactive enhancement, spiral model role of management in software development, role of matrices and measurement, Problem analysis, requirement specification, validation, matrices, monitoring and control.

System Design: Problem partitioning, abstraction, top down and bottom up – design, structured approach, functional versus object oriented approach, design specification and verification matrices, monitoring and control, Cohesiveness, coupling, 4 GL. Visio, DFD, Rational Rose, Visio, VS architectural design.

Coding: TOP-DOWN and BOTTOM-UP structure programming, information hiding, programming style, and internal documentation, verification, metrics, monitoring and control, Subversion, Team System, Source Safe

Testing: levels of testing, functional testing, structural testing, test plane, test class specification, reliability assessment, Software testing strategies, Verification and validation, Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. NUnit for unit testing, Selenium, WebLoad

Software project Management: Cost estimation, project scheduling, staffing, software configuration management, structured Vs unstructured maintenance, quality assurance, project monitoring, risk management. Agile-XP, scrum, Rally, Version One, Bugzilla, Visual Studio Team System, Agile project management, comparison with traditional process, Next generation software engineering

Function oriented and object oriented Software design: Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to real time systems, Object oriented design, Graphical representation of OOD, Generic OO development paradigm.

Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability growth modeling, Software quality, ISO 9000 certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM, NANT, CruiseControl.Net for automated build.

Text Book:

1. Roger S. Pressman : **Software Engineering, A practitioner's Approach,***McGraw-Hill*
2. Ian Sommerville : **Software Engineering**, *Pearson Education.*

Reference Books:

3. Richard Fairley : **Software Engineering Concepts**, *McGraw-Hill.*
4. Robert N. Charette : **Software Engineering Environments,***McGraw-Hill.*
5. S. L. Pfleeger and J.M. Atlee : **Software Engineering Theory and Practice**, *Pearson Education.*
3. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran : **Fundamentals of Computer Algorithms**, *Galgotia Publications*

CSE3212: Software Engineering Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory work based on CSE 3211

CSE3221: Computer Graphics

Credits: 3 **Contact Hours:** 39
Year: Third, **Semester:** Even

Prerequisite: Math, Any Programming Language, Algorithm

Motivation To study how computer, draw and display graphics, and to design 2D/3D graphical user interface.

Course Objective:

The main objective of this course is to provide necessary knowledge on the structure of modern computer graphics systems, basic principles of implementing computer graphics primitives, modelling and rendering graphical data, write basic graphics application programs including animation, synthesize designs, shading and texture mapping algorithms and modern 3D computer graphics

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the structure of modern computer graphics systems, basic principles of implementing computer graphics primitives	P1	
CLO2	To **describe t**he key algorithms for modeling and rendering graphical data	P3	
CLO3	develop a facility with the relevant mathematics of computer graphics	P1	
CLO4	To be able to **write** basic graphics application programs including animation, display graphic images to given specifications	P2	

CLO5	To have ability to **find & combine r**elevant sources and synthesize designs, shading and texture mapping algorithms	P3	
CLO6	design and implement scene graphs	P3	P5
CLO7	demonstrate their ability to use modern 3D computer graphics techniques, models, and algorithms to solve graphics problems.	P2	P4

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents:

Introduction to Computer Graphics and Graphics systems: Overview of computer graphics, representing pictures, preparing, presenting and interacting with pictures for presentations; Visualization and image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active and Passive graphics devices; Computer graphics software.

Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

2D transformation and viewing: Basic transformations: translation, rotation, scaling; Matrix representations and homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

3D transformation and viewing: 3D transformations: translation, rotation, scaling and other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.

Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic Bspline curves, rational B-spline curves.

Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry.

Color and shading models: Light & color model; interpolative shading model; Texture;

Text Book:

1. Donald Hearn and M. Pauline Baker : **Computer Graphics**, *Prentice Hall*
2. Steven Harrington : Computer Graphics: A Programming Approach, *McGraw-Hill College*.

Reference Books:

3. F. S. Hill : **Fundamentals of Computer Graphics,***Prentice Hall*
4. Plastock and Kalley : **Computer Graphics,** *Mcgraw-hill.*
5. Zhigang Xiang & Roy Plastock : **Computer Graphics**, *Mcgraw-hill.*

CSE3222: Computer Graphics LAB

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

CSE 3231: Microprocessor and Assembly Language

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Even

Prerequisite: CSE2111: Digital System Design, CSE2231: Computer Architecture and Organization
Motivation To develop knowledge on Microprocessor architecture and programming skills with Microprocessor

Course Objective: This course introduces to Engineering Graduates the Microprocessor and its Assembly Language programming. The course is designed based on the popular Intel 8086 microprocessor and provides good understanding of the microprocessor operation at the address, data, and control level. The course also covers the software part through teaching of assembly language programming techniques. Microprocessor Interface hardware and support chips are also examined in detail.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **identi**fy the basics knowledge of the architecture of 8086/8085 Microporcessor	P1	P2
CLO2	To **understa**nd how a Microprocessor operates	P3	P4
CLO3	To **incorporate** earned knowledge in software and hardware applications.	P6	

Evaluation/ Assessment System:: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	

Course Contents:

Microprocessor Fundamentals: Architecture of a microprocessor, Data bus, address bus, control bus, I/O units and memory. Architecture of Intel 8086 Microprocessor, its execution unit and bus-interface unit, its registers and flags.

Programming Model: Programming model of 8086 processor, segment-offset address and physical address calculations, even and odd addressing, introduction of different addressing modes, Operating systems and BIOS, Memory organization of a PC, Introduction to IMB PC Assembly Language, Assembly Language syntax, Program Data, Variables, Named constants, program structure, memory models, Input/Output instruction, Running program, Program Segment Prefix.

The processor status and the Flag register, Overflow condition, Debugging a program, Flow control: Flow control instructions, Conditional jumps, signed versus unsigned jumps, High-level language structures, branching and looping structures. Logic Operation: Logic, Shift and Rotate Instruction, some common applications of Shift and Rotate operations. Data Structure: The Stack and Introduction to Procedures, Basic stack operations,

Arithmetic Operation: Multiplication and Division Instructions, signed versus unsigned multiplications, Divide overflow, Signed Extension of Dividend. Arrays: Arrays and related addressing modes, DUP operator, Register indirect modes, Based and Indexed addressing modes. String Manipulation: The string instructions, director flag, Moving a string, storing a string, Loading a string, scanning a string, comparing

strings, substring operation..

Text Book:

1. Ytha Yu and CharlersMarut : **Assembly Language Programming and Organization of the IBM PC,** *McGraw- Hill*

Reference Books:

1. Rafiquzzaman : **Microprocessor and Microcomputer based System Design** *Crc Press Publication*
2. D. V. Hall : **Microprocessors and Interfacing**, *McGraw-Hill*
3. Ramesh Goanker : **Microcomputer Interfacing**, *McGraw-Hill*

CSE3232: Microprocessor and Assembly Language Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3231

CSE 3241: Operating System and System Programming

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Even

Prerequisite: CSE1111 Introduction to Computer Systems, CSE2121 Data Structure
Motivation To know basic of operating system, its services, system programming and resource management issues.

Course Objective:
The main objective of this course is to understand the basic components of a computer operating system, the interactions among the various components, policies for CPU scheduling, deadlocks, memory management, process synchronization, system calls, file systems, virtual memory, and paging.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand**basic OS services, system programming and resource management.	P1	P2
CLO2	To **design** and **construct** system calls, process synchronization, schedulers, memory management systems, virtual memory and paging systems.	P3	P4
CLO3	To **compare** both pre-emptive and non-pre-emptive scheduling of tasks.	P5	
CLO4	To **evaluate** and **report** appropriate design choices when solving real-world problems.	P12	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction: Introduction to OS. Operating system functions, evaluation of O.S., Different types of O.S.: batch, multi-programmed,time-sharing, real-time, distributed, parallel.

System Structure: Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (simple, layered, virtual machine), O/S services, system calls.

Process Management: Processes: Concept of processes, process scheduling, operations on processes, co-operating processes, interprocess communication.

Threads: overview, benefits of threads, user and kernel threads.

CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithms (FCFS, SJF, RR, priority), algorithm evaluation, multi-processor scheduling.

Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores.

Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.

Storage Management: Memory Management: Background, logical vs. physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging.

Virtual Memory: background, demand paging, performance, page replacement, page replacement algorithms (FCFS, LRU), allocation of frames, thrashing.

File Systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance.

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

Disk Management: Disk reliability, disk formatting, boot block, bad blocks.

Protection & Security: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threat monitoring, encryption.

Text Book:

1. Abraham Silberschatz and Peter Baer Galvin : **Operating Systems Concepts**, *Wiley Publisher*.
2. Donovan : **Systems Programming**, *McGraw-Hill.*

Reference Books:

1. Tanenbaum : **Operating Systems**, *Prentice-Hall*
2. Terrence : **Unix System Programming in C++**,*Prentice Hall* Publication

CSE3242: Operating System and System Programming Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE3241

ICE3261: Communication Engineering

Credits: 3 **Contact Hours:** 39
Year: Third **Semester:** Odd

Prerequisite: MATH2111: Matrices and Differential Equations, MATH1111:Algebra, Trigonometry and Vector

Motivation To accrue adequate knowledge required to understand and maintain electronic communication.

Course Objective:

The course objective is to cover the principles of analog and digital communication systems involving different modulation and coding schemes in the background of noise and interference. This course provides broad knowledge of how these systems work from a system engineering view point and an ability to apply to real-world problems.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the different terminologies and techniques of communication.	P1	
CLO2	To **analyze** the working principle of different modulation techniques.	P2	
CLO3	To **demonstrate**the satellite & fiber-optic communication technology.	P1	
CLO4	To **illustrate** different propagation techniques.	P1	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours**where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Fundamentals: Communication Engineering Fundamentals, Waveforms Spectra, Periodic waveforms and its properties, Fourier series, Noise and its different types.

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

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

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

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

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

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

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

Text Book:

1. Behrouz A. Forouzan : **Data Communications and Networking**,*Tata McGraw-Hill Edition*

Reference Books:

1. William Stallings : **Data and Computer Communications**, *Prentice Hall International, Inc.*
2. John M. Senior : **Optical Fiber Communications**,*Prentice-Hall of India Pvt Ltd*
3. Andrew S. Tanenbaum : **Computer Networks**, *Prentice Hall of India Pvt. Ltd*

ICE3262: Communication Engineering Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on ICE3261

Part-IV, Odd Semester

CSE 4111: Parallel Processing and Distributed System

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

Prerequisite: CSE2231: Computer Architecture and Organization.
Motivation To know basic of parallel and distributed system, design and implementation of parallel and distributed applications.

Course Objective:
The objective of this course is to introduce the fundamentals of parallel and distributed processing, including system architecture, programming model, and performance analysis. It will focus on the basic architectural, programming, and algorithmic concepts in the design and implementation of parallel and distributed applications. The specific topics include, but not limited to, multithreaded programming, message passing interface, GPU, and cloud computing.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **summarize** the security issues with distributed systems and techniques available to increase system security.	P1	P2
CLO2	To **apply** parallel algorithms in problem solving.	P3	
CLO3	To **analyze** the performance of a parallel/distributed solutions.	P3	P4
CLO4	To **evaluate** whether a parallel and distributed application is efficient or not and propose techniques to increase the performance.	P6	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction: Trends towards parallel processing, Parallel processing mechanism, Multiprogramming and Time sharing, Parallel Computer Structures, Parallelism and Pipelining, Parallel processing applications, Speedup Performance Laws, Parallel Random Access Machines (PRAM) and VLSI model.

Hardware Technology: Advanced processor Technology, Superscalar and Vector processor, Shared memory organization, Design of Linear and Nonlinear Pipeline processor, Multiprocessor System Interconnects.

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

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

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

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

Text Book:

1. Kai Hwang (Senior Consulting Edition) : **Advanced Computer Architecture Parallelism**, Scalability, Programmability, *McGraw Hill.*
2. James Martin : **Design and Strategy for distributed data processing**, *Prentice Hall*.

Reference Books:

1. Kai Hwang, Faye A. Briggs : **Computer Architecture and Parallel Processing**, *McGraw Hill*
2. Tanenbaum and Van Steen. : **Distributed Systems: Principles and Paradigms**. *Prentice Hall*.

CSE4112: Parallel Processing and Distributed System Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4111

CSE4121: Object Oriented Design and Design Patterns

Credits: 3 **Contact Hours:** 39
Year: FourSemester: Odd

CSE4121: Object Oriented Design and Design Patterns /
CSE4121: Software Design and Architecture

Prerequisite: CSE1221: Object Oriented Programming, CSE3111: Software Engineering, CSE3211: System Analysis and Design,

Motivation: To learn object oriented design, design patterns and different software architecture used to design any secure software.

Course Objective:

This course takes Java beginners to the next level by covering object-oriented analysis and design. Students will discover how to create modular, flexible, and reusable software, by applying object-oriented design principles and guidelines. And, they will be able to communicate these designs in a visual notation known as Unified Modelling Language (UML). It also extends object-oriented analysis and design by incorporating design patterns to create interactive applications. Through a survey of established design patterns, students will gain a foundation for more complex software applications. Students will study the ways different architectures are represented, both in UML and other visual tools. Based on an understanding of architectural styles, they will review architectures for web applications, then explore the basics of Service-Oriented Architecture (SOA) in two approaches: Web Services (WS*) and Representational State Transfer (REST) architecture.

CLO (Course Learning Outcome):			
CLOs	After completing this course, students will be able to:	**PLO mapping**	
CLO1	Explain and apply object-oriented modeling principles and their purpose (e.g., abstraction, encapsulation, decomposition, generalization).	P1	
CLO2	Express object-oriented models as Unified Modeling Language (UML) class diagrams and can apply design guidelines for modularity, separation of concerns, information hiding, and conceptual integrity to create a flexible, reusable, maintainable design.	P2	
CLO3	Demonstrate how to use design patterns to address user interface design issues and Identify the most suitable design pattern to address a given application design problem.	P3	
CLO4	Apply design principles (e.g., open-closed, dependency inversion, least knowledge) i.e. the model-view-controller architectural pattern.	P3	
CLO5	Compare the components, connections, protocols, topologies, constraints, tradeoffs, and variations of different types of architectural styles used in the design of applications and systems.	P9	
CLO6	Describe SOA (Service-Oriented Architecture) to structure web-based systems.	P3	

CLO7	Explain WS* services (i.e., SOAP over HTTP, WSDL, UDDI, BPEL) and can Apply REST architecture (i.e., JSON over HTTP, URI).	P4	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1& 2	Class Test 3 & 4	Assignment	Presentation	Final Written	Attendance
CLO1			√	√	√	√
CLO2	√			√	√	√
CLO3			√	√	√	√
CLO4	√			√	√	√
CLO5		√		√	√	√
CLO6			√	√	√	√
CLO7		√		√	√	√

Course Contents

Object-Oriented Analysis and Design: Software Architect and Design Roles in Industry, Object-Oriented Modeling, Software Requirements, Conceptual and Technical Designs, Competing Qualities and Trade-offs, Record, Organize, and Refine Components

Object-Oriented Modeling: Bridging Concepts and Solutions, Languages Evolution, Abstraction**,** Encapsulation, Decomposition,Generalization, Abstraction in Java and UML, Encapsulation in Java and UML**,** Decomposition in Java and UML, Generalization with Inheritance in Java and UML, Generalization with Interfaces in Java and UML

Design Principles: Coupling and Cohesion, Separation of Concerns, Information Hiding, Conceptual Integrity, Inheritance Issues, UML Sequence Diagram, UML State Diagram, Model Checking

Design Patterns: Creational & Structural Patterns: What is a Design Pattern?, Creational, Structural, and Behavioural Patterns, Singleton Pattern, Factory Method Pattern, Facade Pattern, Adapter Pattern, Composite Pattern, Proxy Pattern, Decorator Pattern

Behavioural Design Patterns: Template Method Pattern, Chain of Responsibility Pattern, State Pattern, Command Pattern, Observer Pattern

Working with Design Patterns & Anti-patterns:MVC Pattern, Liskov Substitution Principle, Open/Closed Principle, Dependency Inversion Principle, Composing Objects Principle, Interface Segregation Principle, Principle of Least Knowledge, Code Smells

UML Architecture Diagrams: Architecture Overview and Process, Kruchten's 4 + 1 Model View, UML Component Diagram, UML Package Diagram, UML Deployment Diagram, UML Activity Diagram

Architectural Styles: Abstract Data Types and Object-Oriented, Main Program and Subroutine, Databases, Layered Systems, Client Server n-Tier, Interpreters, Pipes and Filters, Event Based, Process Control

Architecture in Practice: Quality Attributes, Analyzing and Evaluating an Architecture, Relationship to Organizational Structure, Product Lines and Product Families

Web Technologies: Introduction to Service-Oriented Architecture, Service Principles, Web Systems Evolution, Web Systems Architecture, HTML / XML / JSON, HTTP, JavaScript, Remote Procedure Call (RPC), Object Brokers

Web Services: Introduction to Web Services, Service Invocation (SOAP), Service Description (WSDL), Service Publication and Discovery (UDDI), Service Composition (BPEL)

REST Architecture for SOA: Introduction to REST, Designing a REST Service, Introduction to Microservices, REST Services (Practice)

Text Book:

1. Erich Gamma : Design Patterns: Elements of Reusable Object-Oriented Software
2. John Sonmez : Soft Skills: The software developer's life manual

Reference Books:

3. Robert C. Martin : Clean Code: A Handbook of Agile Software Craftsmanship
4. Steve McConnell : Code Complete
5. Steve Freeman, Nat Pryce : Growing Object-Oriented Software, Guided by Tests

CSE4122: Object Oriented Design and Design Patterns Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4121

CSE4131: Computer Simulation and Modeling

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

Prerequisite: MATH2231:Numerical Methods, STAT1211:Statistics for Engineers
Motivation To develop fundamental knowledge of computer simulation and modeling and understand its necessity and applicability.

Course Objective:

In many real-life scenarios, it is not possible to apply a new hypothesis directly to the system. In that situation simulation is the only solution to test the new ideas' usability or applicability. For situations, where complex mathematical computation is needed, computer-generated simulation is the must. Modeling real-world objects in a computing system are an integral part of computer simulation. Bing a CS graduate, each student must have some core knowledge about computer simulation and modeling. And they must be familiar with some popular simulation tools too.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the different terminologies related with computer modeling and simulation.	P1	P2
CLO2	To **analyze**the real-life problems and create mathematical model of it.	P2	P3
CLO3	To **analyze**the real-life problems and use the acquired knowledge to model it in computer.	P2	P5
CLO4	To **produce** the computer simulated solution for a given mathematical model.	P3	P5

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Simulation methods: Introduction to Simulation, Random number generator, analogue simulation of continuous system, Discrete system simulation, Simulation of a pert network, Statistical analysis of result, Validation and verification techniques, Application of simulation to problems e.g. business, operation

research, operating system, Computer design, Introduction to simulation packages, Computer animation.

Modelling: Introduction to modelling techniques, Problems, models and systems, Modelling concepts, Logic for (conceptual) modelling, Logic programming for conceptual modelling, Concepts of relational modelling and its practice. Some practical modelling e.g. Relational Database modelling, Different methods for Curves and surface modelling, Fractals, Polyhedral modelling with Euler's formula, Advanced modelling, Procedural models. Case Study: Simulation and Modelling software: SimScript.

Text Books:

1. J. A. Spriet : **Computer Aided Modelling& Simulation**, *Academic Press, Inc. Orlando, FL, USA.*
2. Richard Lehman : **Computer Simulation and Modeling**, *Lawrence Erlbaum Associates Publishers.*
3. G. Cordon : **System Simulation**,*Prentice Hall*

CSE4132: Computer Simulation and Modeling Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4131

CSE 4141: Computer Peripherals and Interfacing

Credits: 3 **Contact Hours:** 39
Year: Four**Semester:** Odd

Prerequisite: CSE2111: Digital System Design, CSE3231: Microprocessor and Assembly Language
Motivation To develop hardware knowledge and programming skills on computer interfacing

Course Objective: The main objective of this course is to provide knowledge on basis of interfacing techniques, interfacing devices and to make the student understand on critical programming techniques for using peripheral devices so that they develop skill in designing real worldapplications. The presentation of work is very important part of this course. Therefore, this course aims to improve their capacity to explain any design using proper English and to use mathematical notation and terminology correctly.

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **identi**fy the basics knowledge required for microprocessor interfacing	P1	P2
CLO2	To **understa**nd the procedure of how interface microprocessor and microcontroller	P3	
CLO3	To **apply** their knowledge for real world applications	P3	P4
CLO4	To **analyze** the performance required for different applications and development platform	P6	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Basic concepts of microprocessor interfacing: reviews of address decoding concepts, Input and Output

port design, decoder, encoder, mutliplexer, demultiplexer.

Interfacing peripherals: Peripheral I/O and memory mapped I/O, Interfacing with external memory, microprocessor controlled data transfer and peripheral controlled data transfer, Peripheral I/O instruction for Intel 8085 Microprocessor and its timing diagram. Interfacing with LED, seven segment display, Push-button keys, Matrix keyboard, AD and DA converter.

Programmable Interface device**:** 8212, Programmable devices with Handshake signals, 6155/8156 multipurpose programmable devices, Interfacing seven segment LED using 8155, 8155 timer, 8155 I/O ports in Handshake modes and its interfacing example, Interfacing 8355/8755 Programmable I/O ports, 8279 programmable keyboard/display interface and its interfacing example, 8255 Programmable peripheral interface, Block diagram of 8255, its different mode of operation, Interfacing A/D converter using 8255, Application of 8259, 8257 PPI. Parity check, BAUD, RS 232 standard, Software versus programmable hardware approach, software controlled asynchronous serial I/O, 8085 serial I/O SOD and SID, Hardware controlled serial I/O using programmable chips, 8251 programmable communication interface and its block diagram, interfacing RS 232 Terminal using the 8251A.

Text Book:

1. Rafiquzzaman : **Microprocessor and Microcomputer based System Design,***CRC-Press*
2. Ramesh Goanker **Microcomputer Interfacing**, *McGraw-Hill*

Reference Books:

1. D. V. Hall : **Microprocessors and Interfacing**, *McGraw-Hill*
2. Y. Liu and G. A. Gibson : **Microcomputer Systems: 8086/8088 Family**, *Prentice-Hall*
3. Artwick : **Microcomputer Interfacing**, *Prentice Hall.*
4. James E. Powell : **Designing User Interfaces**, *Microtrend Books San Marcos, CA, USA*
5. D. V. Hall : **Microprocessors and Interfacing**, *McGraw-Hill*

CSE4142: Computer Peripherals and Interfacing Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4141

CSE 4151: Design of VLSI Circuits and Systems

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

CSE 4152: sign of VLSI Circuits and Systems Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4151

CSE 4161: Management Information System

Credits: 3 **Contact Hours:** 39
Year: Four**Semester:** Odd

Prerequisite: None
Motivation To improve understanding of the impact of information systems on business processes and competitiveness in a global setting.

Course Objective:
The objective of this course is to introduce the students to the Management Information Systems and its application in organizations. The course would expose the students to the managerial issues relating to information systems and help them identify and evaluate various options in Management Information Systems. The students also would understand the activities that are undertaken in acquiring an Information System in an organization.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	PLO mapping	
CLO1	To **understand** contemporary MIS theory, Role and Importance of Management. Process of Management. Organization Structure and Theory.	P1	
CLO2	To **explain** systems development and project management methodologies.	P1	P2
CLO3	To **illustrate** analytical thinking, creativity and business-problem-solving as applied to ongoing MIS challenges, future trends, and relevant case studies.	P3	P5
CLO4	To **examine** how the Internet and World Wide Web provide a global platform for e-business, business mobility and communications, collaboration, and cloud computing.	P4	P6

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Introduction to Management Information System (MIS). Role and Importance of Management. Process of Management. Organization Structure and Theory.

Basis of Management Information System, Decision Making, Information, Systems, System Analysis and Design, Development of MIS.

Application of Management Information System, Application in Manufacturing Sectors, Decision Support System, Enterprise Management System, Electronic Commerce (e-commerce), Fundamentals of e-commerce, Models of e-commerce, Retailing in e-commerce, Models of Business to Business e-commerce.

Technology in Management Information System, Business Process Re-engineering.

Text Book:

1. W.S. Jawadekar : **Management Information Systems**,*Tata McGraw-Hill*

Reference Books:

1. Efraim Turban, Jae Kuy Lee, Jae Kyu Lee, Michael Chung : **Electronic Commerce**: A Managerial Perspective,*Prentice Hall*
2. James A. O'Brien, George M. Marakas : **Management Information Systems**, *McGraw-Hill*

CSE4162: Management Information System Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4161

CSE 4171: Computational Geometry

Credits: 3 **Contact Hours:** 39
Year: Four**Semester:** Odd

Prerequisite: MATH1111:Algebra, Trigonometry and Vector, CSE3221:Computer Graphics
Motivation To know the techniques and concepts needed for the design and analysis of geometric algorithms and data structures.

Course Objective:
The course aims to involve students to rigorous algorithmic analysis for problems in Computational Geometry. And introduce them to applications of Computational Geometry to graphical rendering. Teach them the notions of Voronoi diagrams and Delaunay Triangulations. And develop expected case analyses for linear programming problems in small dimensions.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the usage of a variety of geometric data structures and algorithms	P1	
CLO2	To **identify** and **compare** the characteristics and the performance of geometric data structures and algorithms	P1	P2
CLO3	To **choose** the appropriate geometric data structures and sorting algorithms based on criteria related to functionality, time/space complexity and hardware requirements.	P2	P5
CLO4	To **apply** fundamental techniques for designing data structures and algorithms suitable for geometric problems	P4	P5

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√`	√

Course Contents:

Introduction: historical perspective, geometric preliminaries. Convex hulls algorithms in 2d and 3d, lower bounds.

Triangulations: polygon triangulations, representations, point-set triangulations, planar graphs;

Voronoi diagrams: construction and applications, variants;

Delayney triangulations: divideand- conquer, flip and incremental algorithms, duality of Voronoi diagrams, min-max angle properties;

Geometric searching: pointlocation, fractional cascading, linear programming with prune and search, finger trees, concatenable queues, segment trees, interval trees;

Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems;

Arrangements of lines: arrangements of hyperplanes, zone theorems, many-faces complexity and algorithms;

Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets, polytopes and hierarchies, polytopes and linear progarmming in d-dimensions, complexity of the union of convex sets, simply connected sets and visible regions;

Sweep techniques: plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements;

Randomization in computational geometry: algorithms, techniques for counting; Robust geometric

computing; Applications of computational geometry.

Text Book:

1. M. d. Berg, O. Schwarzkopf, M. v. Kreveld and M. Overmars : **Computational Geometry: Algorithms and Applications**, *Springer.*

Reference Books:

1. F. P. Preparata and M. I. Shamos : **Computational Geometry: An Introduction**, *Springer*.
2. J. O. Rourke : **Computational Geometry in C**, *Cambridge University Press*.

CSE4172: Computational Geometry Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4171

CSE 4181:Digital Image Processing

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

Prerequisite: CSE 3131: Digital Signal Processing
Motivation To know basic of the digital image processing concepts and its applications

Course Objective:

The aim of this course is to introduce to the students the basics of digital image processing. The students will gain overview about the available techniques on image smoothing and enhancements in space and frequency domain, different types of compressions, image segmentation and morphological analysis. The student will be able to perform the basic techniques and apply them in practice

CLO (Course Learning Outcome)			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** digital image space and frequency domain	P1	
CLO2	To **apply** different types of filters on digital image to enhance the quality of an image	P3	P5
CLO3	To **analyze** imagesmorphologically and **compare** different compression techniques	P4	
CLO4	To **detect** theedges of an image required for feature extraction	P12	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks.** There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	**Assessment Tools (Total 100%)**					
	20%				**70%**	**10%**
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Introduction and Fundamental to Digital Image Processing: Origin of Digital Image Processing, Examples that use Digital Image Processing, Fundamental steps in Digital Image Processing, Components of Digital Image Processing System, Image sensing and acquisition, Image sampling, quantization and representation,

Basic gray level transformation, Histogram processing, Basics of spatial filtering, Smoothing and

Sharpening Spatial filters, Introduction to Fourier Transform and the Frequency Domain, Discrete Fourier Transform. Smoothing and Sharpening Frequency-Domain filters.

Image Restoration: Image Degradation/Restoration Process, Noise models, Restoration in presence of noise, Inverse Filtering, Minimum Mean Square Filtering, Geometric mean filter, Geometric transformations.

Color Image Processing: Color Fundamentals, Color models,

Image Compression fundamentals, Image compression models, Error free compression, lossy compression.

Morphological image processing: Preliminaries, Dilations and Erosion, opening and closing, Some basic morphological algorithms.

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, thresholding, Region oriented segmentation. Representation, Description and Recognition: Representation-chain codes, polygonal approximation and skeletons,

Text Book:

1. J Rafeal C. Gonzalez & Richard E. Woods : **Digital Image Processing,** *Prentice-Hall Publication*

Reference Books:

1. A. K. Jain : **Fundamentals of Digital Image Processing,***Academic Press*.

CSE4182: Digital Image Processing Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4181

CSE4192: Thesis/Project (Part-I)

25 Marks [(35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral]
1 Credit, 26 Contact hours

Each student has to complete one project in the combined duration of two semesters of Part-IV. In odd semester course CSE 4192 (Part-I), a student has to make a proposal defense at the end of the semesters. The defensed project has to be completed in the continuation course CSE 4292 (Part-II) in even semester of Part-IV.

Part-IV, Even Semester

CSE 4211: Artificial Intelligence

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Even

Prerequisite: CSE2131: Discrete Mathematics, STAT2111: Theory of Statistics
Motivation To introduce students to the basic concepts and techniques of Artificial Intelligence (AI).

Course Objective:
The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, and learning. Also introduces students to Prolog language as a tool for programming AI related problems. Additionally the course develops an understaning of some applications areas of AI, including Neural Network, Fuzzy logic and Robotics.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the key components of the artificial intelligence (AI) field and its relation and role in Computer Science.	P1	
CLO2	To **explain** propositional and predicate logic and their roles in logic programming.	P2	P1
CLO3	To **identify** and **explain** artificial intelligence techniques, including search heuristics, knowledge representation, automated planning and agent systems, machine learning, and probabilistic reasoning.	P2	P4
CLO4	To **develop** a basic proficiency in a traditional AI	P3	P2
CLO5	To master the skills and techniques in machine learning, such as decision tree induction, artificial neural networks, and robotics.	P5	P6

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√		√`	√

Course Contents:

Introduction: History of AI - Intelligent agents – Structure of agents and its functions - Problem spaces and search - Heuristic Search techniques – Best-first search - Problem reduction - Constraint satisfaction - Means Ends Analysis.

Knowledge Representation: Approaches and issues in knowledge representation- Knowledge - Based Agent- Propositional Logic – Predicate logic – Unification – Resolution - Weak slot - filler structure – Strong slot - filler structure.

Reasoning under uncertainty: Logics of non-monotonic reasoning - Implementation- Basic probability notation - Bayes rule – Certainty factors and rule based systems-Bayesian networks – Dempster - Shafer Theory - Fuzzy Logic.

Planning and Learning: Planning with state space search - conditional planning-continuous planning - Multi-Agent planning. Forms of learning - inductive learning - Reinforcement Learning - learning decision trees - Neural Net learning and Genetic learning.

AI programming languages: Introduction to PROLOG, knowledge representation, domain, predicate, clauses, database, back tracking, unification, list, and compound object using prolog.

Introduction to selected topics in AI: Neural Networks, Expert system, Robotics and Fuzzy logic.

Text Book:

1. Staurt J. Russel and Peter Norvig : **Artificial Intelligence: A modern Approach**, *Pearson Education Asia*
2. D. W. Patterson : **Introduction to Artificial Intelligence and Expert System**,*Prentice-Hall of India*
3. Carl Townsend : **Introduction to Turbo Prolog**, *Sybex Inc.*

Reference Books:

1. Patrick Henry Winston : **Artificial intelligence**, *Pearson Education Inc*.
2. N. P. Padhy : **Artificial Intelligence and Intelligent System**, *Oxford University Press*
3. Elaine Rich, Kevin Knight and ShivashankarB.Nair : **Artificial Intelligence**,*Tata McGraw-Hill*

CSE4212: Artificial Intelligence Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4211

CSE 4221: Web Engineering

Credits: 3 **Contact Hours:** 39
Year: Four2 **Semester:** Even

Prerequisite: CSE3151: Computer Networks
Motivation To provide students with conceptual and practical knowledge, and skills required to develop web applications and web services.

Course Objective:
The course introduces students to the discipline of web Engineering including the methods and techniques used in web-based system development. In contrast to traditional software engineering, web engineering methods and techniques must incorporate unique aspects of the problem domain such as: document oriented delivery, fine-grained lifecycles, user-centric development, client-server legacy system integration and diverse end user skill levels. This course draws upon student's previous programming and computing experience to develop practical web development and maintenance skills. This course is intended for students with knowledge of both Internet communication concepts and an introductory programming knowledge (Java &Javascript)..

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the basic concepts and techniques of web engineering.	P1	
CLO2	To **identify** and **discuss** the security risk of a Web application.	P2	P4
CLO3	To **apply** the web engineering methodologies for Web application development.	P2	P3
CLO4	To **develop** a web application using server side programming languages and components.	P3	P5
CLO5	To **develop** a component based web solution and use UML diagrams to describe such a solution.	P5	P6

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√

CLO3		√	√	√	√	√
CLO4		√	√		√`	√

Course Contents:

Web Engineering: Attributes of Web based system and Application, Web App Engineering Layers, Web Engineering Process

Web App Project: Formulation Web based Systems, Planning for Web Engineering Project, Building Web Engineering Team, Web App Project Management, Metrics for web engineering and Apps.

Web Apps Analysis: Requirement Analysis, Analysis Model, Web Apps Estimation, Content Model.

Web Apps design: Design issues of Web Apps, Interface Design, Typography, Layout design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Object Oriented Hypermedia Design, Design Metrics for web Apps.

Web Apps Implementation: Client side scripting: Java Script, AJAX, JQuery; Server Side Scripting: ASP.NET, PHP; Framework: PHP MVC frameworks (Code Igniter, Symfony, Zend, CakePHP) ASP.NET MVC Framework, Web Service.

Web Apps Security: Encryption techniques (digital signatures, certificates, PKI), Security threats, Securing client/server interactions, Vulnerabilities at the client (desktop security, phishing, etc.) and the server (cross-site scripting, SQL injections, etc.), Building Secure Web Apps.

Testing Web Apps: Content Testing, User Interface Testing, Navigation Testing, Configuration Testing, Security Testing, Performance Testing.

Maintenance of Web Applications: Web Server and Database server load balancing, web apps performance assessment, Application usage monitoring and report generation

Text Book:

1. Roger Pressman and David Lowe : **Web Engineering**, *Tata McGraw Hill Edition*, 2008

Reference Books:

1. Dino Esposito : **Programming Microsoft ASP.NET 2.0**, *Microsoft Press, 2005*
2. Matt J. Crouch : **ASP.NET and VB.NET web programming**, *Pearson, 1st Edition, 2002*

CSE4222: Web Engineering Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4221

CSE 4231:Cryptography and Network Security

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Even

Prerequisite: ICE 3261: Communication Engineering
Motivation To know basic of cryptography and network security, different secure protocol, network security issues

Course Objective:

The main objective of this course is to completely understand what ICT security is and how real scenarios can be affected by the lack of security. Students will learn how cryptography can support security and why this is not sufficient, needing to be embodied into shared standards. The course provides also an overview on other tools used for guaranteeing the security of networks, applications, and systems. Students will become familiar with the main attack techniques and will be able to choose and use secure protocols and other tools/systems for security that are indispensable for network administration and design of secure applications.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **illustrate** various Public key and Symmetric key cryptographic techniques.	P1	P2
CLO2	To **apply** various security mechanisms.	P3	
CLO3	To **analyze** the vulnerabilities in any computing system and hence be able to design a security solution.	P3	P4
CLO4	To **evaluate** authentication protocols and requirements.	P6	
CLO5	To **solve** the intrusion attacks.	P12	

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√			√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	
CLO5			√		√	

Course Contents:

Overview: Cryptography Overview and Terminologies.

Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Simplified DES, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, Block Cipher Design Principles, Evaluation Criteria for AES, The AES Cipher, Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher, Placement of Encryption Function, Traffic Confidentiality, Key Distribution.

Number theory: Fields, algebraic closures, Integers - divisibility, primes, testing primes, factorization, Euclideanalgorithm

Public-Key Encryption: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key Management.

Network Security:

Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Authentication Protocols.

Network Security Practice: Kerberos, Pretty Good Privacy, S/Mime, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Web Security Considerations, Secure Socket Layer and Transport Layer Security.

System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Countermeasures, Firewalls.

Text Book:

1. Bruce Schneier : **Applied Cryptography**, *John Wiley & Sons.*
2. W. Stallings : **Cryptography and Network Security Principles and Practice**, *Prentice Hall.*

Reference Books:

1. Dieter Gollmann : **Computer Security**, *John Wiley and Son.*
2. E. Biham and A. Shamir : **Differential Crypt Analysis of the Data Encryption Standard**, *Springer Verlag.*

CSE4232: Cryptography and Network Security Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 262 Contact hours

Laboratory works based on CSE4231

CSE4241: Wireless Communication

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

Prerequisite: ICE 3261: Communication Engineering
Motivation To know the basics of wireless communication and design principle of wireless networks.

Course Objective:
The necessity of wireless communications is increasing day by day, especially in enterprise environment. Network designers have to face different challenges of designing collision free wireless communication. In order to be prepared for tomorrows challenges, CS graduates need to have some core knowledge about wireless communication and designing a wireless enterprise network. The objective of this course is to provide such core designing concept to the CS graduates.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain**different terminologies and techniques of wireless communication.	P1	
CLO2	To **demonstrate** the concept of cellular mobile communications.	P1	
CLO3	To **apply**different security principles for ensuring secure wireless communication.	P2	P5
CLO4	To**analyze** real-world issues and designthe core architecture of a reliable wireless network accordingly.	P3	P5

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√	

Course Contents:

Introduction To Wireless Communication Systems: Evolution of mobile radio communications, examples of wireless comm. systems, paging systems, Cordless telephone systems, comparison of various wireless systems.

Modern Wireless Communication Systems: Second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Blue tooth and Personal Area networks.

Introduction to Cellular Mobile Systems: Spectrum Allocation, basic Cellular Systems, performance Criteria, Operation of cellular systems, analog cellular systems, digital Cellular Systems.

Cellular System Design Fundamentals: Frequency Reuse, channel assignment strategies, handoff Strategies, Interference and system capacity, tracking and grade off service, improving coverage and capacity.

Multiple Access Techniques For Wireless Communication: Introduction to Multiple Access, FDMA, TDMA, Spread Spectrum multiple Access, space division multiple access, packet ratio, capacity of a cellular systems.

Wireless Networking: Difference between wireless and fixed telephone networks, development of wireless networks, fixed network transmission hierarchy, traffic routing in wireless networks, wireless data services, common channel signaling, ISDN (Integrated Services digital Networks), advanced intelligent networks. Wireless LAN Technogy - IEEE 802.11 Wireless LAN Standard - Bluetooth.

Intelligent Cell Concept And Application: Intelligent cell concept, applications of intelligent micro-cell Systems, in-Building Communication, CDMA cellular Radio Networks.

Text Book:

1. William Stallings : **Wireless Communications and Networks**, *Prentice Hall*
2. Theodore S. Rappaport : **Wireless Communications**, *Pearson Education*

Reference Book:

1. John G. Proakis : **Digital Communications**, *McGraw-Hill International*
2. W.C.Y.Lee; : **Mobile Cellular Telecommunication**,*McGraw Hill*
3. JochenSchille : **Mobile Communications**,*Pearson*

CSE4242: Wireless Communication Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4241

CSE4251: Multimedia System

Credits: 3 **Contact Hours:** 39
Year: Four**Semester:** Even

Prerequisite: CSE4181:Digital Image Processing, CSE3151;Computer Networks
Motivation To know the issues of multimedia data format, properties and applications.

Course Objective:
The objective of this course is to acquire knowledge and skills required to plan, design and implement multimedia systems and technologies. This course teaches the principles and current technologies of multimedia systems, describes the ways in which multimedia information is captured, processed, and rendered and the major steps in some of the image, video and audio compression standards. It also introduces multimedia quality of service (QoS) and analyses the ways in which multimedia data is transmitted across networks. Privacy and copyright issues in the context of multimedia are discussed.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **understand** the key components of multimedia technologies, applications and the characteristics of each media type including text, graphics, voice, video and animation.	P1	P2
CLO2	To **explain** approaches to represent multimedia data in digital format and identify their properties, data organization, indexing, retrieval and finally, the implications of copyright in the use of multimedia.	P2	P3
CLO3	To **describe** multimedia operating system issues such as real-time operation, resource management, process management, file systems, and Multimedia networking.	P3	P4
CLO4	To **analyze** image, video and audio in the frequency domain to identify important components to be encoded, the protocols, standards and representation techniques used for storage and transmission of multimedia information.	P2	
CLO5	To **compare** different network protocols and to describe mechanisms for providing QoS guarantees in the network.	P4	
CLO6	To **apply** multimedia data and techniques on a practical application.	P3	P5

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√				√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	√
CLO4		√	√	√	√`	
CLO5		√	√	√	√	
CLO6			√		√	

Course Contents:

Multimedia systems: introduction; Coding and compression standards; Architecture issues in multimedia.

Operating systems issues in multimedia: real-time OS issues, synchronization, interrupt handling.

Database issues in multimedia: indexing and storing multimedia data, disk placement, disk scheduling, searching for a multimedia document.

Networking issues in multimedia: Quality-of-service guarantees, resource reservation, traffic specification, hoping and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions;

Security issues in multimedia: digital water-marking, partial encryption schemes for video streams.

Multimedia applications: audio and video conferencing, video on demand, voice over IP.

Text Book:

1. Ze-Nian Li and Mark S. Drew : **Fundamentals of Multimedia**, *Pearson*

Reference Books:

1. John Villamil-Casanova and Louis Molina : **Fundamentals of Multimedia**, *Pearson*
2. Tay Vaughan : **Multimedia: An Introduction**, Prentice Hall India.
3. Ranjan Parekh : **Multimedia: Making It Work**, *McGraw-Hill*
4. Jose Lozano, Louis Molina and John Willif : **Principles of Multimedia**,*Tata McGraw-Hill, 2007.*

CSE4252: Multimedia System Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

Laboratory works based on CSE4251

CSE4261: Distributed Database Management System

Credits: 3 **Contact Hours:** 39
Year: Four **Semester:** Odd

Prerequisite: CSE3151: Computer Networks,CSE3121 Database Management Systems
Motivation To accrue adequate knowledge about the distributed environment, distributed file-system and database management system.

Course Objective:

Gigantic amount of data is generated in our daily life. And the volume is increasing day by day. Conventional DBMS are not sufficient to manage and process these enormous amounts of data. Distributed database management systems are different from conventional DBMS. To be able to manage and process these huge amounts of data CS graduates must have a clear understanding of DDBMS.

CLO (Course Learning Outcome):			
CLOs	After successfully completing this course, students will be able	**PLO mapping**	
CLO1	To **explain** the different terminologies and techniques related to distributed database management system (DDBMS).	P1	
CLO2	To **demonstrate** different architectures of DDBMS.	P1	
CLO3	To **design** efficient query for DDBMS.	P2	P3
CLO4	To **design**, **deploy**and maintainDBMS.	P2	P3

Evaluation/ Assessment System: Students are evaluated out of total **75 Marks**. There are different types of assessment tools. In **the final written** examination, total time **is 3 hours** where students should answer Six questions from two sections out of Eight taking not more than Three from each section. The detail with **COs-Assessment Mapping** is given below.

CLOs	Assessment Tools (Total 100%)					
	20%				70%	10%
	Class Test 1	Class Test 2	Assignment	Presentation	Final Written	Attendance
CLO1	√			√	√	√
CLO2	√		√	√	√	√
CLO3		√	√	√	√	
CLO4		√	√		√`	

Course Contents:

Introduction: Distributed Data processing, Distributed database system (DDBMSS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS

Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control

Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing Introduction To Transaction Management: Definition of Transaction, Properties of transaction, types of transaction

Distributed Concurrency Control:Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms. Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

Text book

1. M.T. Ozsu and P. Valduriez : **Principles of Distributed Database Systems**,*Pearson.*
2. S. Ceri and G. Pelagatti : **Distributed Databases principles and systems**,*Tata McGraw Hill*
3. Andrew S. Tanenbaum : **Distributed Database**,*Pearson*.

CSE4262: Distributed Database Management System Lab

25 Marks [60% Practical, 30% Quizzes/Viva-voce, 10% Attendance]
1 Credit, 26 Contact hours

CSE4280: Board Viva-Voce

50 Marks [100% Viva-voce]
2 Credits

The Board viva-voce will be conducted by the Examination Committee.

CSE4292: Thesis/Project (Part-II)

50 Marks [(35% Internal Examiner, 35% External Examiner, 30% Presentation and Oral]
2 Credits, 52 Contact hours

This course is a continuation of the course CSE 4192 (Part- I) from the odd semester Part- IV. A student has to complete the defended project proposal, submit it by the end of the semester and make an oral defense of the project.