MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

SYLLABUS

BACHELOR OF SCIENCE IN
COMPUTER SCIENCE AND ENGINEERING (CSE)

APPLICABLE FOR CSE – 19 TO ONWARD BATCHES AND REVISED FOR CSE-18

REVISED ON JANUARY 2019

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CSE)
MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY (MIST)
MIRPUR CANTONMENT, DHAKA-1216, BANGLADESH

PREFACE

Military Institute of Science and Technology (MIST) offers undergraduate and graduate programs in the field of science and engineering. This syllabus is for the undergraduate students in the Department of Computer Science and Engineering (CSE) of MIST. Although this syllabus has been written mainly for the students, student advisers and teachers will find it valuable as a reference document. Also, anybody who desires to know about the course contents of CSE Department will find this book helpful.

This syllabus provides general information about MIST, its historical background, faculties and departments. Different aspects of the course system, such as rules and regulations relating to admission, grading system, requirement for degrees have been elaborated. It describes the course requirements, course objectives, detailed course outline and courses offered in different terms.

The fields of Computer Science and Computer Engineering are changing rapidly. So the departmental as well as the non-departmental courses for CSE students have been revised to cater for recent advancements in these fields. The introduction of a basic course on computer systems for a gentle introduction of the field to the newcomers is among the worth mentionable changes. Number of subjects in some semesters has also been reduced keeping the total credit hour almost unchanged. Moreover, students now have more freedom in subject selection to specialize in a certain direction in their final years.

The CSE Program of MIST presently follows the OBE (Outcome Based Education) approach for conducting courses. Consequently, Integrated Design Project, which is one of OBE's salient features, has been introduced from 2019 in all corresponding undergraduate batches. The revised curriculum as incorporated in this syllabus is approved by the committee of courses. It will be placed before the academic council, MIST for necessary approval. CSE undergraduate students of all running batches (CSE-16, CSE-17, CSE-18 and onwards) will be under this revised syllabus from January 2019.

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

Dhaka, Bangladesh
January 2019

Air Commodore Md Afzal Hossain, ndc, psc
Head (Dept of CSE)

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CHAPTER 1

GENERAL INFORMATION

1.1 Introduction to MIST

Military Institute of Science and Technology (MIST), the pioneer Technical Institute of Armed Forces, started its journey from 19 April 1998. It was the visionary leadership of the Honorable Prime Minister of People's Republic of Bangladesh Sheikh Hasina to establish a Technical Institute of Armed Forces. Accordingly, the Honorable Prime Minister, People's Republic of Bangladesh, Sheikh Hasina unveiled the Foundation Plaque on 19 April 1998.MIST is located at Mirpur Cantonment, which is on the northwest of Dhaka City. Mirpur Cantonment is well known to be as an Education Village of Bangladesh Armed Forces, a hub of knowledge for military and civil professionals. First Academic Program at MIST was launched on 31 January 1999 with the maiden batch of Civil Engineering (CE). The pioneer batch comprised of only military students. Computer Science & Engineering (CSE) Program got underway from academic session 2000-2001. Following those Programs, Electrical, Electronic & Communication Engineering (EECE) and Mechanical Engineering (ME) programs including induction of Civil Students (both male and female) in various disciplines started from the session 2002-2003. Aeronautical Engineering (AE) program started at MIST from academic session 2008-2009. The department of Naval Architecture and Marine Engineering (NAME) began its journey from academic session 2012-201.The department of Nuclear Science and Engineering (NSE), the department of Biomedical Engineering (BME), the department of Architecture (Arch) and the department of Environment, Water and Coastal Engineering (EWCE) started their journey from academic session 2014-2015, and from academic session 2015-2016, the department of Petroleum and Mining Engineering (PME) and department of Industrial and Production Engineering (IPE) started their journey. Foreign students from Sri Lanka were admitted for the first time at MIST. Presently students from Maldives, Palestine, Nepal and Ghambia are also studying in different Engineering Programs. MIST envisages creating facilities for military as well as civil students from home and abroad dedicated to pursue standard curriculum leading to Graduation Degree. As an Institution without any gender biasness, MIST is already on steady stride upholding its motto "Technology for Advancement". MIST remains committed to contributing to the wider spectrum of national educational arena and play a significant role in the development of human resources and ardently pursuing its goal to grow into a "Centre of Excellence".

MIST has well equipped class rooms with multimedia and web camera with internet facilities and laboratories with modern equipment. The medium of instruction for all engineering programs is English. All academic programs of MIST are affiliated with the Bangladesh University of Professionals (BUP) and have close cooperation with Bangladesh University of Engineering and Technology (BUET) and Dhaka University (DU). Academic Session ofMIST normally starts in the last week of January. Admission process starts in September/October and Admission Test held in November every year. Admission formalities are completed by December/January. The total number of intake in a year is 595. In general a maximum of 50% seats are allocated to Armed Forces Officers. MIST has other miscellaneous facilities such as Medical Centre, Fitness Centre, Cyber Cafe, Broadband Internet facilities, Library and Students' Accommodation (Male & Female). Out of twelve programs, so far five departments of MIST namely CE, EECE, ME, CSE and AE have achieved accreditation from BAETE (IEB) which is certainly considered to be a pronounced achievement for its academic excellence in national and international arena.

1.2 Attributes of MIST

MIST is an educational entity where there is an opportunity of blending civil and military students with diversified skills, exposure, experience and outlook. Attributes those may be considered as strengths of MIST are:

- Rigorous admission and selection process for best possible screening.
- Interactive sessions in the classroom.
- Regular guest lectures and educational visits.
- Tradition of timeliness, commitment and uninterrupted curriculum.
- Flexibility in choosing competent faculties through outsourcing.
- Well thought-out and continuous feedback and assessment system.
- Effective teaching through innovative method.
- Industrial attachment for on job training.
- Emphasis on code of conduct and dress code.
- Focus to develop students as a good human with all possible attributes of successful leader.
- Continuous effort to build strong industry-academia bondage.
- Tranquil, pollution free and secure campus life.

1.3 Mission and Vision of MIST

1.3.1 Vision of MIST

To be a centre of excellence for providing quality education in the field of science, engineering and technology to create diverse quality leaders and professionals and conduct innovative research to meet the national and global needs and challenges.

1.3.2 Mission Statement

MIST is working on the following missions:

i. To provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology and engineering management

ii. To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio- economic development of Bangladesh and global needs

iii. To conduct collaborative and research activities with national and international communities for continuous interaction with academia and industry

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

1.4 Objectives

- To establish a prestigious academic institute for studies in different fields of engineering and technology for military personnel and civil officials/ students from home and abroad at degree and post graduate levels.
- To organize courses on military science and technology in various areas of interest.
- To hold examinations and confer certificates of diplomas/ degrees, other academic distinctions, to and on persons who have persuaded a course of study and have passed examinations conducted by the institute.

- To confer research degrees, award fellowship, scholarship, exhibition, prizes, medals and honorary degrees to persons who have carried out research works under conditions as prescribed in the MIST regulations.
- To make provisions for advisory, research and consultation service including supervisions, material testing and to enter into suitable agreement with any persons/organizations for this purpose.
- To co-operate with Universities / Technical Institutions (both military and civil) including signing of Memoranda of Understanding (MOU) at home and abroad, in the manner and purpose as the institute may determine.
- To do such other acts, related to above-mentioned objectives, as may be required in order to expand the objectives of the institute.

1.5 Location

MIST is located at Mirpur Cantonment, northwest edge of the greater Dhaka city, a hub of knowledge for the armed forces. Mirpur Cantonment is a small, calm and quiet education village and free from all possible pollution of a city life. A garland like lake with migratory birds, three sides with extended green fields in the summer and water bodies in the rainy season, whistling birds on the tree branches and overall bounty of nature adds to the already existing splendid academic atmosphere. Other neighboring academic institutions are National Defense College (NDC) and Defense Services Command and Staff College (DSCSC) – two international standard education centers.

1.6 Capabilities

- To conduct under-graduate programs leading to B.Sc. Engineering Degrees in the following disciplines:
  - ✓ Civil Engineering (CE)
  - ✓ Computer Science and Engineering (CSE)
  - ✓ Electrical, Electronic and Communication Engineering (EECE)
  - ✓ Mechanical Engineering (ME)
  - ✓ Aeronautical Engineering (AE)
  - ✓ Naval Architecture and Marine Engineering (NAME)
  - ✓ Bachelor of Architecture (B. Arch)
  - ✓ Environment, Water and Coastal Engineering (EWCE)
  - ✓ Nuclear Science and Engineering (NSE)
  - ✓ Biomedical Engineering (BME)
  - ✓ Industrial and Production Engineering (IPE)
  - ✓ Petroleum and Mining Engineering (PME)
- To conduct post graduate program (Ph.D, M.Sc, M. Engg).
- To conduct diploma courses in surveying & mapping.
- To conduct diploma and certificate courses in CSE.
- To conduct professional advanced courses.

1.7 Affiliation

All academic programs of MIST are affiliated with the Bangladesh University of Professionals (BUP). All examinations are conducted as per the schedule approved by the same university. BUP also approves the results and awards certificates amongst the qualified students.

1.8 Faculties

1.8.1 Faculty of CE:

- Civil Engineering (CE)
- Architecture (Arch)
- Civil, Environment, Water and Coastal Engineering (CEWCE)
- Petroleum and Mining Engineering (PME)

1.8.2 Faculty of ECE:

- Computer Science and Engineering (CSE)
- Electrical, Electronic and Communication Engineering (EECE)

1.8.3 Faculty of ME:

- Mechanical Engineering (ME)
- Aeronautical Engineering (AE)
- Naval Architecture and Marine Engineering (NAME)
- Industrial and Production Engineering (IPE)

1.8.4 Faculty of Science and Engineering:

- Biomedical Engineering (BME)
- Nuclear Science and Engineering (NSE)
- Department of Science (Mathematics, Physics, Chemistry) and Humanities (Only Post Graduate)

Presently MIST has 12 (twelve) departments to conduct B Sc. Engineering program under 04(four) different engineering faculties. The departments impart education basing on common objectives and outcomes set by MIST and have defined program objectives and outcomes, specific to the departments respectively.

1.8.5 Computer Science and Engineering (CSE) Department

Department of CSE has started its journey from academic session 2000-2001. The department is currently offering undergraduate program B.Sc. in CSE as well as graduate and postgraduate programs (Ph.D, MSc and M.Engg) in CSE. With its excellent professional competence, pragmatic curriculum, expert teaching viewpoints and capabilities of training, B.Sc. in CSE degree program has achieved accreditation from BAETE (lEB) on 10 July 2013 with a grade as "Good". This department produces highly qualified and skilled computer science graduates. Over the years, this rapidly flourishing department has been providing the technical foundation, scholarly guidance and leadership skills to the undergraduate and postgraduate students who proved their potentiality at home and abroad. Major areas of specialties of CSE program are Software, Hardware, Networking, Computer Graphics & Image Processing, Artificial Intelligence & Robotics, System Analysis Design & Development, and Information Systems Security etc. At present sufficient faculties specialized from different background (civil, military and foreign) are serving in this department. In addition a good number of senior faculties from renowned universities like BUET, Dhaka University conduct courses as guest faculties. This department offers adequate facilities for carrying out innovative research works in the field of CSE.

1.9 Eligibility of Students for Admission in MIST (Subject to review each year)

The students must fulfill the following requirements:

1.9.1 For Bangladeshi Students

Minimum qualifications to take part in the admission test are as follows:

1. Applicants must have passed SSC/Dhakhil/equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.00 in a 5-point scale.

2. Applicants must have passed HSC/Alim/equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.00 in a 5-point scale.

3. In HSC/Alim/equivalent examination the applicant must have obtained minimum "A" grade in any two (02) subjects out of four (04) subjects including Mathematics, Physics, Chemistry & English and minimum "A-" (A minus) grade in rest two (02)subjects.

4. Applicants with GCE "O" Level/equivalent background must have to qualify in minimum five (05) subjects including Mathematics, Physics, Chemistry and English with minimum "B" grade in average.

5. Applicants with GCE "A" Level/equivalent background must have to qualify in minimum three (03) subjects including Mathematics, Physics and Chemistry with minimum "B" grades separately.

6. Applicants who have passed HSC or equivalent examination in the current year or one year before the notification for admission can apply.

7. Sex: Male and female.

1.9.2 For Foreign Students

Maximum 3% of overall vacancies available will be kept reserved for the foreign students and will be offered to foreign countries through AFD of the Government of the People's Republic of Bangladesh. Applicants must fulfill the following requirements:

1. Educational qualifications as applicable for Bangladeshi civil students or equivalent.
2. Must have security clearance from respective Embassy/ High Commission in Bangladesh.
3. Sex: Male and female.

1.10 Admission Procedure

1.10.1 Syllabus for Admission Test

Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (Comprehension and Functional) subjects of HSC examinations of all Boards of Secondary and Higher Secondary School Certificates. Admission test will be conducted out of 200 marks and the syllabus and distribution of marks is given below:

Serial	Subjects	Syllabus	Marks
1	Mathematics	Syllabi of the current year of HSC Examinations of all Boards of Intermediate and Secondary Education	80
2	Physics		60
3	Chemistry		40
4	English	Comprehension and functional	20
Total			**200**

1.10.2 Final Selection

Minimum qualifying marks in the written admission test is 40%. But in special circumstances for fulfillment of specified number of seats, President Admission Committee with approval from Commandant, MIST, may consider relaxation of this condition. Merit list of candidates for final selection and admission to MIST will be prepared on the basis of the following:

Written Admission Test	75%.
GPA of SSC/ Dakhil (without 4th subject) / "O"level/ equivalent examination	10%.
Total GPA of Mathematics, Physics and Chemistry of HSC/ Alim/ "A" level/ equivalent examination	15%.
Total	**100%**

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

1.10.3 Medical Checkup

Civil candidates selected through admission test will go for medical checkup in MIST/CMH. If the medical authority considers any candidate unfit for study in MIST due to critical/contagious/mental diseases as shown in medical policy of MIST will be declared unsuitable for admission.

1.11 Withdrawal Policy

MIST has been established with an aim of providing quality education in various disciplines of Engineering leading to B.Sc Engineering to be conferred by BUP. A definite standard of education and general discipline will be followed in every level of the program.The unsuccessful students will therefore be withdrawn from the institute.

1.11.1.1 Definition of Terms

Permanent Withdrawal

It will imply a complete/permanent discontinuity from any course/program of the institute.

Temporary Withdrawal

It means that the student has been allowed by the Academic Council, MIST to discontinue temporarily from any course/program for a definite period. The student, so withdrawn, mayre-enter the course as per terms and conditions as set by the authority.

Permanent Expulsion

It means expulsion permanently from the institution on disciplinary ground. A student, if expelled permanently will never be allowed to re-enter the course or similar program in MIST and be subjected to other terms and conditions as set by the authority while approving the permanent expulsion order.

Temporary Expulsion

It means expulsion from an academic course/program for a certain period on disciplinary ground. A student, if expelled temporarily, may be allowed to re-enter the course/program on expiry of the punishment period and on fulfillment of other terms and conditions (if any) asset by the authority while approving the temporary expulsion order.

1.11.2 General Policy of Withdrawal

The under graduate (B.Sc) Engineering programs, in all Engineering disciplines are planned for 04 regular levels, comprising of 08 regular terms and for B. Arch it is planned for 05 regular levels, comprising of 10 regular terms. It is expected that all students will earn degree by clearing all the offered courses in the stipulated time. In case of failure MIST Examination policies will be adopted. Few salient aspects extracted from the existing MIST Exam Policies are as followings:

- Students failing in maximum two courses/subjects in any level, each comprising of two regular terms will be allowed to appear in the referred/re-examination on failed course(s)/subject(s) after a short term as per academic schedule. In case of Sessional Course referred examination will be allowed to maximum one course.
- Referred/re-examination, after a short term is to be conducted within 02 (two) weeks of commencement of the next academic session at the latest.
- Students failing in maximum one course/subject in the referred/re-examination will be promoted to the next higher level. The failed course/subject will be termed as "Backlog" subject and the students have to pass the "Backlog" subject in the next scheduled referred/re-examination, but without any short term. Otherwise, he/she will be withdrawn permanently from the course/program.
- No student will be allowed to appear in the referred/re-examination in the same subject more than twice in the whole undergraduate program. No 'Backlog' subject is allowed to Sessional Courses and students subjected to Referred in a Sessional Course must qualify during Referred Exam. Otherwise, he/she will be withdrawn permanently from the course/program.
- Students in all levels will be allowed to appear in the referred/re-examination on two courses/subjects including the "Backlog" one.
- Students will be promoted to the second term of each level irrespective of their results in the first term of the level.
- Students failing in three or more courses/subjects in any level, comprising of two regular terms, will be allowed to repeat the level once. Students repeating a level will be granted exemption for that/those subject(s) in which they earned "B+" and above grade in the

previous academic year. For a military student, repeating a level will be subject to the approval of the respective Services Headquarters.

- Students will be allowed to repeat a particular level only once in the whole undergraduate program.
- After level-4 referred/re-examination, if any military student fails in maximum one course/subject, but not the "Backlog" subject, then he/she will leave MIST and will be allowed to appear in the next scheduled referred/re-examination of the respective course. In that examination if he/she cannot pass the course/subject, or if he/she does not appear in the referred examination within 06 (six) years of registration will lose the scope of completing graduation. This failure will also be recorded in the dossier of military student officers.
- In case of sickness, which leads to missing of more than 40% classes or miss term final examination (supported by requisite medical documents), students may be allowed to withdraw temporarily from that term and repeat the whole level with the regular level in the next academic session, subject to the approval of Academic Council, MIST. However, he/she has to complete the whole undergraduate program within 06 (six) academic years from the date of his/her registration.
- Whatever may be the cases, students have to complete the whole undergraduate program within 06 (six) academic years from the date of registration.
- Failure to secure/achieve minimum CGPA of 2.20 in two consecutive levels will also lead to withdrawal of the student from the program.

1.11.3 Expulsion/Withdrawal on Disciplinary Ground

1.11.3.1 Unfair Means

Adoption of unfair means may result in expulsion of a student from the program and so from the institution. The Academic Council of MIST will authorize such expulsion on the basis of recommendation of the Disciplinary Committee, MIST and as per policy approved by the affiliating university. Following would be considered as unfair means adopted during examinations and other contexts:

- Communicating with fellow students for obtaining help in the examination.
- Copying from another student's script/report/paper.
- Copying from desk or palm of a hand or from other incriminating documents.
- Possession of any incriminating document whether used or not.

1.11.3.2 Influencing Grades

Academic council of MIST may expel/withdraw any student for approaching directly or indirectly in any form to influence a teacher or MIST authority for grades.

1.11.3.3 Other Indiscipline Behaviors

Academic council of MIST may withdraw/expel any student on disciplinary ground, if any form of indiscipline or unruly behavior is seen in him/her which may disrupt the academic environment/program or is considered detrimental to MIST's image.

1.11.3.4 Immediate Action by the Disciplinary Committee of MIST

The disciplinary committee, MIST may take immediate disciplinary action against any student of the institution. In case of withdrawal/expulsion, the matter will be referred to the academic council, MIST for post-facto approval.

1.11.4 Withdrawal on Own Accord

1.11.4.1 Permanent Withdrawal

A student who has already completed some courses and has not performed satisfactorily may apply for a permanent withdrawal.

1.11.4.2 Temporary Withdrawal

A student, if he/she applies, may be allowed to withdraw temporarily from the program, subject to the approval of academic council of MIST, but he/she has to complete the whole program within 06 (six) academic years from the date of his/her registration.

CHAPTER 2

THE DEPARTMENT OF COMPUTERSCIENCE AND ENGINEERING

2.1 Introduction to the CSE Program

Computer plays vital and in fact indispensable role in all fields of modern human activities. Consequently, Computer Science and Engineering has established itself as one of' the most important branches of engineering. Recent development in computer has a considerable impact on society. It has already expanded to all fields of study starting from genetic engineering to space technology. Recent development in Artificial Intelligence has taken the human history a new height. That day is not very far when man can make machine like him.

The Department of Computer Science and Engineering is one of the pioneer Departments of this Institute providing top-quality education in Computer Science and Engineering (CSE) at its undergraduate program. ICT is the leading sector in present day. It is already declared as a thrust sector in Bangladesh. Keeping this in mind the department offers B. Sc in CSE program to produce computer specialists.

In addition to the above, Department of Computer Science and Engineering is launched M.Sc. (Engg)/M. Engg programs in October, 2014 and Ph.D. program in 2016. There are financial assistance program for the poor and meritorious students too.

2.2 Historical Background

Department of Computer Science and Engineering began its journey from the academic session in 2000-2001 as Department of CSIT with military students only. Later, civil students were inducted in the next session. The department was renamed as Department of CSE in January 2003. This year (2017), the 17th batch has begun their classes in Level-1. Over the years, this ever-flourishing department has been providing the technological foundation on ICT, scholarly guidance and leadership skills to the students that have contributed to produce 629 highly qualified and skilled CSE graduates. Our graduates are working proudly both at home and abroad. Besides, a good number of graduates are pursuing higher studies abroad with scholarship. Moreover, our CSE students actively participate in various events, like, national and international computer programming competition, software development competitions, Gaming and Robotic contest, Mobile Apps development, Debate and English speaking competition, national and international seminar and workshops on ICT and exhibit brilliant performances. With the relentless effort of the qualified, sincere and enthusiastic faculty and able guidance of the respected Commandant and Dean of MIST, the department has become a unique one of its field. With its excellent professional competence, expert teaching viewpoints and capabilities of training, B. Sc in Computer Science and Engineering (CSE) degree program has achieved accreditation from BAETE (IEB) on 10 July 2013 with a grade as "Good" and was renewed for three years in 2017.

This department produces highly qualified and skilled computer science graduates. Over the years, this rapidly flourishing department has been providing the technical foundation, scholarly guidance and leadership skills to the undergraduate and postgraduate students who proved their potentiality at home and abroad. Major areas of specialties of CSE department are Software, Hardware, Networking, Computer Graphics & Image Processing, Artificial Intelligence & Robotics, System Analysis Design & Development, Information Systems Security, Research etc.

With proper guidance of the respected Commandant and Dean of MIST, at present 28 faculties specialized from different background (civil, military and foreign) are serving in this department. In addition a good number of senior faculties from renowned universities like BUET, Dhaka University conduct courses as guest faculties. This department also offers adequate facilities for carrying out innovative research works in the field of CSE.

2.3 Study Programs

The Department of Computer Science and Engineering offers the degree of B. Sc. Engg in CSE. The courses and syllabus followed by this department for the above degree is considered to be the most modern ones like that of advanced countries as well as appropriate to the local needs. The syllabus is designed to contain all the necessary study materials so that a graduate can face the engineering problems readily after graduation. Also, the syllabus is reviewed and necessary changes are made in every three years by a "committee of courses" comprising the best academicians and experts of the field of Computer Science and Engineering coming from MIST and other leading Universities and Organizations.

2.3.1 CSE Program

2.3.1.1 Vision Statement

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

2.3.1.2 Mission of the Program

Department of CSE is working with the following missions in mind.

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

2.3.1.3 Program Outcomes

Program Outcomes (POs) represent the knowledge, skills and attitudes the students should have at the end of a four year engineering program. CSE program of MIST has 12 Program Outcomes.

They are briefly described in the following table.

Ser	PO	Category	Description
1	**PO 1**	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO 2**	**Problem Analysis**	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO 3**	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
4	**PO 4**	**Investigation**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5	**PO 5**	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**PO 6**	**The Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO 7**	**Environment and Sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8	**PO 8**	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO 9**	**Individual and Team Work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO 10**	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11	**PO 11**	**Project Management and Finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**PO 12**	**Life Long Learning**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

2.3.1.4 Learning Outcomes (LO)

The Learning Outcomes (LO) are the resultant knowledge skills the student acquires at the end of a course. It defines the cognitive processes a course provides. Chapter 5 contains the detailed Learning Outcomes for each of the courses under the heading of Course Outcome (CO).

2.3.1.5 Generic Skills

The graduates of the CSE program are expected to have the following generic skills.

1. Ability to apply Engineering Knowledge for analyzing complex problems and design innovative solutions.
2. Ability to use modern engineering tools.
3. Ability to anticipate social and cultural impacts on traditional engineering practices.
4. Ability to work effectively as an individual, and as a member or leader of a team in diverse situations.

2.3.1.6 Curriculum/Skill Mapping

The courses of CSE program are designed in such a way that the corresponding Learning Outcomes (LO) contribute to the 12 Program Outcomes (POs) which eventually achieves the mission and vision of the program. Chapter 5 contains the mapping for each of the courses.

2.4 Laboratory Facilities of the Department

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

Software Engineering Lab: This department has a software engineering lab consisting of 60 computers as workstations. With co-located Artificial Intelligence and VLSI lab, class can be conducted for 70 students at a time providing each one PC.

Digital Lab: This department has a digital lab where sessional classes of different courses on digital electronics can be conducted. This lab is enriched with modern electronic equipment and facilities.

Multimedia Lab: This department has a multimedia lab with modern HP color laser printers, multimedia projector, scanner and document cameras. Student would be highly benefited through this lab in their project works.

Artificial Intelligence and VLSI Lab: There is an Artificial Intelligence and VLSI lab consisting of 70 computers as workstations in this department. With co-located software engineering lab, classes can be conducted for 70 students at a time providing each one PC and other equipment.

Network and Internet Lab: This department has a Network and Internet lab of 70 computers as workstations. All necessary network equipment and accessories are available in the lab for conducting sessional classes.

Microprocessor and Microcontroller Lab: This department has a Microprocessor and Microcontroller lab enriched with latest Micro kits.

Interfacing Lab: This department has an interfacing lab where sessional classes of different course on computer interfacing can be conducted. Moreover, students undertaking different interfacing project also are assisted by all required accessories and components. Regular project showcase are held in this lab.

Graphics and Multimedia Lab: This department has a Graphics and Multimedia lab where sessional classes of different course on computer graphics and multimedia theory can be conducted. This lab has 70 computers donated by Indian government in 2013. Moreover, students undertaking different graphics design project also are assisted by all required accessories and components. Regular project showcase are held in this lab.

Image Processing Lab: This department has an Image processing lab of 30 computers donated by Indian government in 2013 as workstations. All necessary image processing equipment and accessories are available in the lab for conducting sessional classes.

Postgraduate Research Lab: Postgraduate Research Lab is a highly furnished Lab equipped with state-of-the art research facilities in the field of ICT. This lab sponsored under the “Info-Sarkar” project of the Government. The lab was inaugurated on 31st August 2016 by Mr. Zunaid Ahmed Palak, MP, Honorable State Minister, ICT Division, Ministry of Post, Telecommunication and Information Technology, Government of the peoples’ Republic of Bangladesh. It will offer cutting-edge research opportunities for the researchers at postgraduate level as well as for the faculty members.

Teacher’s PC Lab: This department has an additional lab for the teachers, who will be mostly helping the students for thesis and/or project work.

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

Labs Planned for Future Expansion: This department will have following labs in future:

(1) VLSI Lab
(2) Cyber Security & Digital Forensic Lab
(3) Mobile Gaming & Apps Development Lab
(4) ICT Training Lab

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

2.5 Research Activities

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

2.6 Co-curricular Activities

Students of this department have achieved remarkable success in co-curricular activities like programming contests, software and hardware project competitions, software fair etc. Besides, students take part and show significant performance in debate, sports and cultural programs.

2.6.1 Programming Contests

Programming team of CSE Department has been participating in various national and international programming contests regularly with remarkable performance. The Department team has been regularly participating in the Dhaka Regional final of ACM (Association for Computing Machinery) International Collegiate Programming Contest (ACM-ICPC). In ACM-ICPC Dhaka Regional 2008, MIST team achieved 7th position and ACM-ICPC Dhaka Regional 2009, MIST team placed 8th position. A group of students from CSE department took part in "IEEE BDS Humanitarian India & Apps Contest-2016, SS12: Code-A Thon Challenge" arranged by Daffodil University and awarded as 2nd Runner Up. A group of students from CSE Dept attended a contest on "ACM ICPC 2016-Dhaka Regional Site" arranged by University of Asia Pacific on 18 & 19 November 2016 and placed 7thposition.

2.6.2 Software and Hardware Project Competitions

CSE department students regularly participate in different software and hardware project competitions and show excellent performance. Notably, in 2011, software named "BANGLA TEXT TO BRAILLE TRANSLTOR" was developed by four CSE graduates from MIST (Md. Osman Gani, F M Mahbub-ul-Islam, Samiul Azam and Ahmad Imtiaz Khan). This software came up as the winner of prestigious "BASIS IT Innovation Search Program 2011"and runner up of "National Digital Innovation Award 2011". A team from CSE dept attended "University Rover Challenge (URC)-2014" and "URC-2015", which is held annually in the desert of southern Utah in the United Statesin and secured 12th and 9th position out of 31 and 56 teams respectively. 12 students from Dept of CSE participated in "European Rover Challenge-2016" an international Robotic competition arranged by European Space Foundation from 10-13 September in Poland.

2.6.3 Collaboration with industry and Govt. organization

The CSE department of MIST is collaborating with different industries and Govt. organizations. One of the organizations is Bangladesh Association of Software & Information Services (BASIS). BASIS provides efficient guideline about IT related industrial needs to the students. They arrange classes and seminars for the students on present industry requirement on ICT matters and show the way of satisfying those. Every year level-3 students undergo industrial training with different renowned software firms, networking organization, telecommunication companies, govt. organization etc. Students are exposed to the real world challenges that enrich their vision and make them courageous to accept hardship of up-coming future. This department always gets splendid support from ICT division of the Government on various issues like arranging workshop and seminar for faculty and students, establishing various highly affluent laboratories and sometimes providing financial supports for insolvent students of MIST. In August, 2016 Postgraduate Research Lab was established here with state-of-the art research facilities in the field of ICT. It will offer cutting-edge research opportunities for the researchers at postgraduate level as well as for the faculty members. Some important laboratories named VLSI Lab, Cyber Security & Digital Forensic Lab, Mobile Gaming & Apps Development Lab, and ICT Training Lab are also sponsored by ICT division. Various organization arrange on campus job fair for final year students from where qualified students are directly recruited to those organization. Every year one of the renowned leading career management site "BD Jobs" organize job fair in MIST that helps the students to manage their career more efficiently.

2.6.4 Sports and Cultural Programs

CSE Department became champion in inter-departmental Programming Contest-2010, Inter-departmental Table Tennis Competition-2011, Inter-departmental Basketball Competition-2011 and Inter-departmental Volleyball Competition-2011.They also became champion in inter-departmental sports and cultural competition-2016 and Runner Up in inter-departmental cricket competition-2016.

CHAPTER 3

<u>RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM</u>

3.1. Overview

MIST has introduced course system for undergraduate studies from the academic session 2017 - 18. Therefore, the rules and regulations mentioned in this paper will be applicable to students for administering undergraduate curriculum through the Course System. This will be introduced with an aim of creating a continuous, even and consistent workload throughout the term for the students.

3.2. The Course System

The salient features of the Course System are as follows:

a. Number of theory courses will be generally 5 in each term. However, with the recommendation of course coordinator and Head of the Department, Commandant MIST may allow relaxation in this regard. This relaxation is to be reported to Academic Council of MIST.
b. Students will not face any level repeat for failing.
c. Students will get scope to improve their grading.
d. Introduction of more optional courses to enable the students to select courses according to their individual needs and preferences.
e. Continuous evaluation of students' performance.
f. Promotion of student-teacher interaction and contact.

Beside the professional courses pertaining to each discipline, the undergraduate curriculum gives a strong emphasis on acquiring thorough knowledge in the basic sciences of mathematics, physics and chemistry. Due importance is also given on the study of several subjects in humanities and social sciences.

The first two years of bachelor's degree programs generally consist of courses on basic engineering, general science and humanities subjects; while the third and subsequent years focus on specific disciplines.

3.3. Number of Terms in a Year

There will be two terms in an academic year.

1. Term I (Spring)
2. Term II (Fall)

In addition to these two regular terms there will be a short term after the Term II of each academic session. During the short term, students can take only failed courses to cover up the credit deficiencies.

Respective departments will take the decisions about courses to be offered during each short term depending upon the availability of course teachers and number of students willing to take a particular course.

3.4. <u>Duration of Terms</u>

The duration of each of Term I (Spring) and Term II (Fall) is maximum 22 weeks. Following table has the breakdown of a typical term.

Ser	Events	Durations
1.	Classes before Mid Term	7 weeks
2.	Mid Term Vacation	1 week
3.	Classes after Mid Term	7 weeks
4.	Makeup Classes and Preparatory leave	2/3 weeks
5.	Term Final Examination	2/3 weeks
6.	Term End Vacation	1/2 week

The duration of a Short Term will be around 7 weeks of which about 6 weeks will be spent for class lectures and one week for Term Final Examination. The duration for Short Term and Examination will be as under:

1.	Classes	6 weeks
2.	Final Examination	1 week
Total		**7 Weeks**

3.5. Course Pattern and Credit Structure

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

3.6. Course Designation System

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

a. The first digit corresponds to the year/level in which the course is normally taken by the students.

b. The second digit is reserved for departmental use. It usually identifies a specific area/group of study within the department.

c. The last digit is an odd number for theoretical courses and an even number for sessional courses.

The course designation system is illustrated as Follows:

CSE- 1 0 1 **Discrete Mathematics**

Course Title

Odd digit designates a theoretical course

Reserved for departmental use

Signifies 1st Year/ 1st Level course

Department identification code

CSE- 2 0 4 **Data Structures Sessional**

Course Title

Even digit designates a sessional course

Reserved for departmental use

Signifies 2nd Year/ 2nd Level course

Department identification code

3.7. Assignment of Credits

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

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

b. Sessional Courses: Credits for sessional courses is half of the class hours per week per term.

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

3.8. Types of Courses

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

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

b. Prerequisite Courses: Some of the core courses are identified as prerequisite courses for a specific subject.

c. Optional Courses: Apart from the core courses, the students can choose from a set of optional courses. A required number of optional courses from a specified group have to be chosen.

3.9. Course Offering and Instruction

The courses to be offered in a particular term are announced and published in the Course Catalog along with the tentative Term Schedule before the end of the previous term. The courses to be offered in any term will be decided by Board of Undergraduate Studies (BUGS) of the respective department. The courses that have been eliminated in the reviewed syllabus may be offered as deemed necessary due to failed or not registered in these courses in previous terms by any student.

Each course is conducted by a course teacher who is responsible for maintaining the expected standard of the course and for the assessment of students' performance. Depending on the strength of registered students (i.e. on the number of students) enrolled for the course, the teacher concerned might have course associates and Teaching Assistants (TA) to aid in teaching and assessment.

3.10. Teacher-Student Interaction

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

3.11. Student Adviser

One adviser is normally appointed for a group of students by the BUGS of the concerned department. The adviser advises each student about the courses to be taken in each term by discussing the academic program of that particular term with the student.

However, it is also the student's responsibility to keep regular contact with his/her adviser who will review and eventually approve the student's specific plan of study and monitor subsequent progress of the student.

For a student of second and subsequent terms, the number and nature of courses for which he/she can register is decided on the basis of academic performance during the previous term. The adviser may permit the student to drop one or more courses based on previous academic performance.

3.12. Course Registration

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

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

3.12.2. Pre-conditions for Registration.

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

b. Any student, other than the new batch, with outstanding dues to the MIST or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.

c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any term, the concerned department (BUGS) may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre- requisite course is found to be satisfactory.

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

3.12.4. Penalty for Late Registration. Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 100.00 (One hundred only) per credit hours. Penalty for late registration will not be waived.

3.13. Limits on the Credit Hours to be taken

A student should be enrolled for at least 15 credit hours and is allowed to take a maximum of 24 credit hours. Relaxation on minimum credit hours may be allowed. A student must enroll for the sessional courses prescribed in a particular term within the allowable credit hour limits.

In special cases where it is not possible to allot the minimum required 15 credit hours to a student, the concerned department (BUGS) may permit with the approval of the Comdt, a lesser number of credit hours to suit individual requirements. Such cases are also applicable to students of Level 4 requiring less than 15 credit hours for graduation.

3.14. Course Add/Drop

A student has some limited options to add or drop courses from the registration list. Addition of courses is allowed only within the first two weeks of a regular term and only during the first week of a short term. Dropping a course is permitted within the first four weeks of a regular term and two weeks of a short term.

Any student willing to add or drop courses has to fill up a Course Adjustment Form. This also has to be done in consultation with and under the guidance of the student's respective adviser. The original copy of the Course Adjustment Form has to be submitted to the Registrar's Office, where the required numbers of photocopies are made for distribution to the concerned adviser, Head, Dean, Controller of Examinations and the student.

All changes must be approved by the adviser and the Head of the concerned department. The Course Adjustment Form has to be submitted after being signed by the concerned persons.

3.15. Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to serious illness or serious accident, he/she may apply to the Head of the degree awarding department for total withdrawal from the term before commencement of term final examination. However application may be considered during term final examination in special case. The application must be supported by a medical certificate from the Medical Officer of MIST. The concerned student may opt for retaining the sessional courses of the term. The Academic Council will take the final decision about such applications. However, the total duration for graduation will not exceed 6 academic years.

3.16. The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment, for theory courses this continuous assessment is made through a set of quizzes, class tests, class evaluation, class participation, homework assignment and a term final examination. The assessments for sessional courses are made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. Besides that, at the end there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weightages. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be given as follows:

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

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

3.17. Distribution of Marks

3.17.1. Theory. Marks distribution of Theory courses will be according to exam policy.

3.17.2. Sessional/Practical Examinations. Sessional courses are designed and conducted by the concerned departments. Examination on sessional/practical subjects will be conducted by the respective department before the commencement of term final examination. The date of practical examination will be fixed by the respective department. Students will be evaluated in the sessional courses on the basis of the followings (all or as decided by the Examination Sub-Committee):

a.	Class Participation	5
b.	Class performance/observation	5
c.	Lab Test/Report Writing/project work/Assignment	50
d.	Quiz Test	30
e.	Viva Voce	10
	Total	**100%**

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

Marks distribution of lab based sessionals

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Marks distribution of project based sessionals

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Marks distribution of programming based sessionals

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

3.17.3. Sessional Course of Communicative English. The distribution will be as under:

a.	Class Participation	20
b.	Individual Presentation	20
c.	Quiz	20
d.	Group Presentation	20
e.	Viva Voce	20
Total		**100%**

3.17.4. Basis for awarding marks for Class Participation.
This will be as follows:

	Marks
90% and above	100%
85% to less than 90%	80%
80% to less than 85%	60%
75% to less than 80%	40%
Below 75%	0%

3.18. Collegiate and Non-collegiate

Students having Class Participation of 90% or above in individual subject will be treated as collegiate and less than 90% and up to 75% will be treated as non-collegiate in that subject. The non-collegiate student(s) may be allowed to appear in the examination subject to payment of non-collegiate fee/fine of an amount fixed by MIST/BUP. Students having Class Participation below 75% will be treated as dis-collegiate and will not be allowed to appear in the examination and treated as fail. But in a special case such students may be allowed to appear in the examination with the permission of Commandant and it must be approved by the Academic Council.

3.19. Calculation of CGPA

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes *n* courses in a term having credits of C1, C2, ..., Cn and his grade points in these courses are G1, G2, ...

Gn respectively, then

$$GPA = \frac{Grade\ points\ earned\ in\ the\ semester}{Credits\ completed\ in\ the\ semester}$$

$$= \frac{Summation\ of\ (Credit\ hours\ in\ a\ course * \ Grade\ point\ earned\ in\ that\ course)}{Total\ number\ of\ credit\ hours\ completed}$$

$$= \frac{\sum_{i=1}^{n} \boldsymbol{Ci * Gi}}{\sum_{i=1}^{n} \boldsymbol{Ci}}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of TC1, TC2, ... , TCn and his GPA in these terms are GPA1, GPA2,... , GPAn, respectively then

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

Numerical Example

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

Course	Credit Ci	Grade Points	Gi	Ci*Gi
EECE-163	3.00	A	3.75	11.25
EECE-164	0.75	A+	4.00	3.00
MATH-141	3.00	A-	3.50	10.50
PHY-103	3.00	B+	3.25	9.75
HUM-101	3.00	A	3.75	11.25
HUM-102	1.50	A	3.75	5.625
CSE-101	3.00	A	3.75	11.25
CSE-103	3.00	A-	3.50	10.50
CSE-104	1.5	B+	3.25	4.875
Total	**21.75**			**78.00**

$$\boldsymbol{GPA} = \frac{\mathbf{78.00}}{\mathbf{21.75}} = \mathbf{3.59}$$

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

Level	Term	Earned Credit Hours	Earned GPA	TC_i*GPA_i
		TC_i	GPA_i	
1	I	21.75	3.75	81.5625
1	II	20.75	3.61	74.9075
2	I	19.50	3.21	62.595
2	II	21.00	2.98	62.58
Total		83.00		281.645

$$CGPA = \frac{281.645}{83} = 3.39$$

3.20. Minimum Earned Credit and GPA Requirement for Obtaining Degree

Minimum credit hour requirements for the award of bachelor's degree in engineering (B.Sc. Engineering) and other discipline will be decided as per existing rules. The minimum GPA requirement for obtaining a Bachelor's degree in Engineering and Architecture is 2.20.

3.21. Impacts of Grade Earned

The courses in which a student has earned a 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained an 'F' grade will not be counted towards his/her earned credits or GPA calculation. However, the 'F' grade will remain permanently on the Grade Sheet and the Transcript.

A student who obtains an 'F' grade in a core course will have to repeat that particular course. However, if a student gets an 'F' in an optional course, he/she may choose to repeat that course or take a substitute course if available. When a student will repeat a course in which he/she has previously obtained an 'F', he/she will not be eligible to get a grade better than 'B+' in that repeated course.

If a student obtains a grade lower than 'B+' in a particular course he/she will be allowed to repeat the course only once for the purpose of grade improvement. However, he/she will not be eligible to get a grade better than 'B+' for an improvement course.

A student will be permitted to repeat for grade improvement purposes a maximum of 6 courses in BSc. Engineering programs and a maximum of 7 courses in B. Arch. program.

If a student obtains a 'B+' or a better grade in any course he/she will not be allowed to repeat the course for the purpose of grade improvement.

3.22. Classification of Students

At MIST, regular students are classified according to the number of credit hours completed/ earned towards a degree. The following classification applies to all the students:

Level	Credit Hours Earned	
	Engineering/URP	Architecture
Level 1	0.0 to 36.0	0.0 to 34.0
Level 2	More than 36.0 to 72.0	More than 34.0 to 72.0
Level 3	More than 72.0 to 108.0	More than 72.0 to 110.0
Level 4	More than 108.0	More than 110.0 to 147.0
Level 5		More than 147.0

However, before the commencement of each term all students other than new batch are classified into three categories:

a. **Category 1:** This category consists of students who have passed all the courses described for the term. A student belonging to this category will be eligible to register for all courses prescribed for the upcoming term.

b. **Category 2:** This category consists of students who have earned a minimum of 15 credits but do not belong to category 1. A student belonging to this category is advised to take at least one course less since he might have to register for one or more backlog courses as prescribed by his/her adviser.

c. **Category 3:** This category consists students who have failed to earn the minimum required 15 credits in the previous term. A student belonging to this category is advised to take at least two courses less than a category 1 student subject to the constraint of registering at least 15 credits. However, he will also be required to register for backlog courses as prescribed by the adviser.

Definition of Graduating Student. Graduating students are those students who will have ≤ 24 credit hour for completing the degree requirement.

3.23. Performance Evaluation

The performance of a student will be evaluated in terms of two indices, viz. Term Grade Point Average and Cumulative Grade Point Average which is the grade average for all the terms completed.

Students will be considered to be making normal progress toward a degree if their Cumulative Grade Point Average (CGPA) for all work attempted is 2.20 or higher. Students who regularly maintain a term GPA of 2.20 or better are making good progress toward the degrees and are in good standing with MIST. Students who fail to maintain this minimum rate of progress will not be in good standing. This can happen when any one of the following conditions exists.

a. The term GPA falls below 2.20.

b. The Cumulative Grade Point Average (CGPA) falls below 2.20.

c. The earned number of credits falls below 15 times the number of terms attended.

All such students can make up their deficiencies in GPA and credit requirements by completing courses in the subsequent term(s) and backlog courses, if there are any, with better grades. When the minimum GPA and credit requirements are achieved the student is again returned to good standing.

3.24. Rules for Self-Study Courses

A self-study course is among the regular courses listed in the course catalog. This type of course is offered only in exceptional cases. The following rules are applicable to all self study courses:

a. Whether a course is to be floated as a self study course will be decided by the Head of the concerned department in consultation with the teacher/course coordinator concerned. Such a decision also has to be reported to the Academic Council.

b. A self study course may be offered in a particular term only if the course is not running in that term as a regular course.

c. The self study course is offered to a student in his/her graduating term if it helps him/her to graduate in that term.

d. A student is allowed to register for a maximum of two theory courses on a self-study basis.

e. Students should have 75% Class Participation.

f. Normally no lecture will be delivered for a self study course but laboratory/design classes may be held if they form part of a course.

g. The course coordinator/course teacher will assign homework, administer quizzes, and final examination for giving assessments at the end of the term.

h. No Laboratory/Sessional Course can be taken as self study course.

3.25. Rules for Courses Offered in Short Term

A Short Term course will be conducted after one week of completion of Term II Final Examination in each year. The following rules are applicable to Short Term courses:

a. The courses to be run during the short term shall be decided on the recommendations of departments on the basis of essential deficiencies to be made up by a group of students. Once floated, other students could be allowed to register in those courses subject to the capacity constraints and satisfaction of prerequisites.
b. Student will be allowed to register in a maximum of three theory courses during the Short Term.
c. Graduating students may register for Short Term examinations after finalization of result of Term 2 final examination.
d. A certain fee for each credit hour to be registered to be borne by the students who enroll during Short Term.

3.26. Minimum Earned Credit and GPA Requirement for Obtaining Degree

Minimum credit hour requirements for the award of bachelor's degree in engineering (BSc. Engg) and architecture (B. Arch.) will be decided by the respective department (BUGS). However, at least 157 credit hours for engineering and 189 credit hours for architecture must be earned to be eligible for graduation, and this must include the specified core courses. The minimum GPA requirement for obtaining a Bachelor's degree in engineering and architecture is 2.20.

A student may take additional courses with the consent of his/her Adviser in order to raise GPA, but he/she may take a maximum of 15 such additional credits in engineering and 18 such additional credits in architecture beyond respective credit-hour requirements for Bachelor's degree during his/her entire period of study.

3.27. Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for Bachelor's degree will have to apply to the Controller of Examinations through his/her Adviser for graduation. Provisional Degree will be awarded by BUP on completion of credit and GPA requirements.

3.28. Time Limits for Completion of Bachelor's Degree

A student must complete his studies within a maximum period of six years for engineering and seven years for architecture.

3.29. Attendance, Conduct and Discipline

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

3.29.1. Attendance. All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly and one is required to attend the classes as per MIST rules.

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

3.30. Teacher-Student Interaction

The academic system in MIST encourages students to come in close contact with the teachers. For promotion of high level of teacher-student's interaction, a course coordinator (CC) is assigned to each course. Students are free to discuss with CC about all academic matters. Students are also encouraged to meet other teachers any time for help and guidance for academic matters. Heads of the departments, Director of Administration, Director of Students Welfare (DSW), Dean and Commandant address the students at some intervals. More so, monthly Commandant's Parade is organized in MIST where all faculty members, staff and students are formed up, thereby increasing teacher-student interaction.

3.31. Absence during a Term

A student should not be absent from quizzes, tests, etc. during the term. Such absence will naturally lead to reduction in points/marks, which count towards the final grade. Absence in the Term Final Examination will result in an F grade in the corresponding course. A student who has been absent for short periods, up to a maximum of three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for make-up quizzes or assignments immediately upon return to classes. Such request has to be supported by medical certificate from competent authority (e.g. CMH/MIST Medical Officer).

3.32. Recognition of Performance

As recognition of performance and ensure continued studies MIST awards medals, scholarships and stipends will be given as per existing rules and practices.

3.33. Types of Different Examination

Following different types of final Examinations will be conducted in MIST to evaluate the students of Undergraduate Programs:

a. **Term Final Examination:** At the end of each normal term (after 22wk or so), Term Final Examination will be held. Students will appear in the Term Final Examination for all the theory courses they have taken in the Term.

b. **Short Term Examination:** Short Term may be conducted after one week completion of Term 2 final examination. Students will be allowed to take maximum three theoretical courses in the Short Term. Examination will be conducted at the end of Short Term (6^{th} week class). However, Head of concerned department with the approval of Commandant may decide to take Supplementary examination instead of Short Term. No Laboratory/Sessional Courses can be taken in short term.

c. **Supplementary Examination:** It will take place once in a year, after each term-I final break. It should be completed within first 3 weeks of a new term. Students will be allowed to appear this examination for maximum two subjects at a time. Graduating students will be allowed to appear maximum three subjects during supplementary examination in their last Term. However, Head of the concerned department with the approval of Commandant may decide to take another Supplementary Examination instead of Short Term. In that case, a student will be allowed to take maximum three failed courses or improvement courses in the particular Supplementary Examination. This examination will be conducted in the previous week of the beginning of Term I. Highest achieved grade for all courses of Supplementary Examination will be B+.

d. **Improvement Examination:** It will be taken during supplementary and short term examination. Questions will be same as the question of the regular examination of that Short Term Final Examination (if any). Student can take maximum three subjects at a time and maximum 6 subjects in the whole academic duration. If a student obtains a grade lower than ‘B+’ in a course, he/she will be allowed to repeat the course only once for grade improvement. However, he/she will not be eligible to get a grade better then ‘B+’ for an improvement course. Among the previous result and improvement examination result, best one will be considered as final result for an individual student. However, performance of all examination i,e previous to improvement examination, shall be reflected in the transcript.

e. **Self-Study Course Examination:** Only graduating students (level-4) will be allowed to appear at Self Study course examination. It will be taken with Term Final Examination. No regular class will be arranged for this, but teachers will be assigned for supervising and guiding the students for study, conducting class test/quiz and regular assessment for 30% marks. Maximum two theory courses may be taken as self-study course by a student. Highest achieved grade for these courses will be B+. In that case a student will be allowed to take maximum 24 credit instead of 15 in the last Term of his/her graduation.

3.34. Rules of Different Examinations

3.34.1. Term Final Examination. Following rules to be followed:

a. Registration to be completed before commencement of the class. A student has to register his desired courses paying registration, examination fee and other related fees.

b. Late registration will be allowed without penalty within first one week of the term.

c. Within 1st two weeks of a term a student can Add/Drop course/courses. To add a course, in the 3rd week, one has to register the course by paying additional fees. To drop a course, one has to apply within three weeks and paid fees will be adjusted/ refunded. If anyone wants to drop a course after three weeks and within 4 weeks, that will be permitted but paid fees will not be refunded in that case.

d. Registrar office will finalize registration of all courses within 7 (seven) weeks, issue registration slip and that will be followed by issuing Admit Card.

e. Term Final Examination to be conducted in the 18-20th week of the term as per approved Academic Calendar.

3.34.2. Short Term Examination. Following rules to be followed:

a. Short Term for period of 6 weeks may be offered by a department after one week of completion of Term II Final Examination.

b. Short Term Final Examination is to be conducted on 7th week of Short Term.

c. Only repeat course can be offered, not any fresh course.

d. Classes will be arranged for the students who register a failed course in the Short Term.

e. After 6 (six) weeks of class, in the 7th week short Term Examination will be held. Academic calendar for this Short Term will be declared by the Department during the Mid-Term break of Term-II.

f. One student can take only three (failed/improvement) courses at a time in the Short Term.

g. Students will have to complete registration of course for Short Term by paying all the fees, before starting of the Term-II final Exam.

h. Graduating students may register for Short Term examinations after finalization of result of T 2 final examination.

j. Maximum grading will be ‘B+’.

k. Question Setting, Moderation, Result Publication will be done following the same rules of Term Final Exam as per Exam Policy. Separate Tabulation sheet will be made for this examination.

l. However, Head of concerned department with the approval of Commandant may decide to take Supplementary Examination instead of Short Term. Students will be allowed to take maximum three failed courses/improvement courses in that supplementary examination.

3.34.3. <u>Supplementary Examination</u>.
Following rules to be followed:
a. After the final break of every Term-I, Supplementary Examination will be held (once in a year).

b. Examination will be taken on 70% marks like Term Final examination. Remaining 30% marks on continuous assessment earned previously in that particular course will be counted. If a student fails in a course more than once in regular terms, then best one of all continuous assessment marks will be counted.

c. A student will be allowed to take maximum two courses at a time for each supplementary examination, but in the graduating Term one student can take maximum three courses if required.

d. Highest grade of supplementary examination will be 'B+'.

e. Registration for supplementary courses to be done during the mid-term break of Term 1, paying the required fees.

f. Examination will be completed after Term I End break within three weeks of Term II.

g. If any student fails in a course, he can clear the course retaking it 2nd time or, he can clear the examination appearing at the supplementary examination as well. But anyone fails twice in a course consecutively, he has to take approval of Academic Council of MIST for appearing third/last time in a course and need to pay extra financial penalty.

h. If anyone fails in the sessional course, that course cannot be cleared in the supplementary examination.

j. Question setting, Moderation, Result Publication will be done following the same rules of Term Final Examination as per Examination Policy.

k. However, Head of the concerned department with the approval of Commandant may decide to take another Supplementary Examination instead of Short Term. In that case, a student will be allowed to take maximum three failed courses or improvement courses in that particular Supplementary Examination. This examination will be conducted in the previous week of the beginning of Term 1. Registration of that Supplementary Examination should be completed during registration of Short Term course.

3.34.4. <u>Improvement Examination</u>. Following rules to be followed:
a. Any student gets a grading below 'B+' and desires to improve that course, he will be allowed to appear the improvement examination for that particular course.

b. Highest grade of Improvement examination will be 'B+'.

c. One student is allowed to appear at Improvement exam in 6 (six) courses in his whole graduation period taking maximum three courses at a time.

d. For Improvement examination, registration is to be done before Term 2 Final Examination with the Short Term Courses or, during the registration of Supplementary Courses by paying all the fees.

e. Improvement examination to be taken during the supplementary and short term examinations.

f. Choice of Improvement course is restricted within the offered courses of that Short Term by the Departments and in two courses at a time.

g. Question Setting, Moderation and Result Publication to be done with courses of regular Term Final Examination.

3.34.5. <u>Self-Study Course and Examination</u>. Following Rules to be followed:
a. An irregular student for completion of his graduation, can take maximum two repeat courses as self-study course in the graduating Term if he desires and is accepted by department.

b. One student can take maximum 24 credit hours course in the graduating Term to complete his graduation.

c. Registration for self-study course by paying all fees, must be completed with other course of regular Term.

d. To run the self-study course, concerned Department will assign one teacher each for every self-study course offered. No regular theory class will be held, but that assigned teacher will take necessary class Tests, Quiz Test and give attendance and observation marks to give 30% marks at the end of the Term. For remaining 70% marks written examination will be taken with the Term Final Examination.

e. Assigned teacher for self-study examination will be responsible for setting questions of 70% marks and other examination formalities.

f. Question Setting, Moderation, and Result Publication to be done with courses of Term Final Examination.

g. Grading of Self Study course and examination will be maximum 'B+'.

3.35. Irregular Graduation

If any graduating student clears his/her failed course in Term-1 and his graduation requirements are fulfilled, his graduation will be effective from the result publication date of Term-1 and that student will be allowed to apply for provisional certificate.

CHAPTER 4

COURSE REQUIREMENTS FOR THE STUDENTS OF UNDERGRADUATE PROGRAM (B. Sc in CSE) OF THE DEPARTMENT OF CSE, MIST

Undergraduate students of the Department of Computer Science and Engineering (CSE) have to undertake a particular course schedule, the term-wise distribution of which is given below:

LEVEL-1 TERM-I

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-100	Introduction to Computer Systems Sessional	-	3.00	1.50	
2.	EECE-163	Electrical Circuit Analysis	3.00	-	3.00	
3.	EECE-164	Electrical Circuit Analysis Sessional	-	3.00	1.50	
4.	ME - 181	Basic Mechanical Engineering	2.00	-	2.00	
5.	MATH-141	Mathematics-I (Differential Calculus and Integral Calculus)	3.00	-	3.00	
6.	PHY-103	Physics	3.00	-	3.00	
7.	PHY-104	Physics Sessional	-	1.50	0.75	
8.	HUM-101	Developing English Language Skills I	2.00	-	2.00	
9.	HUM-102	Developing English Language Skills II	-	3.00	1.50	
10.	Shop-140	Workshop Practice Sessional	-	1.50	0.75	
	Total		**13.00**	**12.00**	**19.00**	

LEVEL-1 TERM-II

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-101	Discrete Mathematics	3.00	-	3.00	
2.	CSE-105	Structured Programming Language	3.00	-	3.00	CSE-100
3.	CSE-106	Structured Programming Language Sessional	-	3.00	1.50	
4.	EECE-169	Electronic Devices and Circuits	3.00	-	3.00	EECE-163
5.	EECE-170	Electronic Devices and Circuits Sessional	-	3.00	1.50	
6.	CE-150	Engineering Drawing & CAD Sessional	-	3.00	1.50	
7.	CHEM-101	Chemistry	3.00	-	3.00	
8.	MATH-143	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.00	-	3.00	
	Total		**15.00**	**9.00**	**19.50**	

LEVEL-2 TERM-I

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-201	Digital Logic Design	3.00	-	3.00	
2.	CSE-202	Digital Logic Design Sessional	-	3.00	1.50	
3.	CSE-203	Data Structures and Algorithms-I	3.00	-	3.00	CSE-105
4.	CSE-204	Data Structures and Algorithms-I Sessional	-	3.00	1.50	
5.	CSE-205	Object Oriented Programming Language	3.00	-	3.00	CSE-105
6.	CSE-206	Object Oriented Programming Language Sessional-I	-	3.00	1.50	
7.	EECE-269	Electrical Drives and Instrumentation	3.00	-	3.00	EECE-169
8.	EECE-270	Electrical Drives and Instrumentation Sessional	-	1.50	0.75	
9.	MATH-245	Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)	3.00	-	3.00	
	Total		**15.00**	**10.50**	**20.25**	

LEVEL-2 TERM-II

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-211	Digital Electronics and Pulse Technique	3.00	-	3.00	EECE-169, CSE-201
2.	CSE-212	Digital Electronics and Pulse Technique Sessional	-	1.50	0.75	
3.	CSE-214	Numerical Methods Sessional	-	3.00	1.50	
4.	CSE-215	Data Structures and Algorithms-II	3.00	-	3.00	CSE-101, CSE-203
5.	CSE-216	Data Structures and Algorithms-II Sessional	-	3.00	1.50	
6.	CSE-217	Theory of Computation	3.00	-	3.00	
7.	CSE-220	Object Oriented Programming language Sessional-II	-	3.00	1.50	
8.	CSE-224	Advanced Programming Language Sessional	-	1.50	0.75	
9.	HUM-2XO	Option-I	2.00	-	2.00	
10.	MATH-247	Mathematics-IV (Complex Variable, Laplace Transform and Statistics)	3.00	-	3.00	
	Total		**14.00**	**12.00**	**20.00**	

Option-I

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	HUM-237	Engineering Economics	2.00	-	2.00	
2.	HUM-241	Bangladesh Studies	2.00	-	2.00	
3.	HUM-243	Sociology	2.00	-	2.00	

LEVEL-3 TERM-I

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-301	Database Management Systems	3.00	-	3.00	
2.	CSE-302	Database Management Systems Sessional	-	3.00	1.50	
3.	CSE-303	Compiler	3.00	-	3.00	CSE-217
4.	CSE-304	Compiler Sessional	-	1.50	0.75	
5.	CSE-305	Microprocessors, Micro-controllers and Assembly Language	4.00	-	4.00	CSE-201
6.	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	-	3.00	1.50	
7.	CSE-317	Data Communication	3.00	-	3.00	
8.	CSE-318	Data Communication Sessional	-	1.50	0.75	
9.	CSE-323	Computer Architecture	3.00	-	3.00	CSE-201
	Total		**16.00**	**9.00**	**20.50**	

LEVEL-3 TERM-II

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-307	Operating System	3.00	-	3.00	
2.	CSE-308	Operating System Sessional	-	1.50	0.75	
3.	CSE-309	Computer Network	3.00	-	3.00	
4.	CSE-310	Computer Network Sessional	-	3.00	1.50	
5.	CSE-313	Mathematical Analysis for Computer Science	3.00	-	3.00	
6.	CSE-315	Digital System Design	3.00	-	3.00	CSE-305
7.	CSE-316	Digital System Design Sessional	-	1.50	0.75	
8.	CSE-319	Software Engineering	3.00	-	3.00	
9.	CSE-360	Integrated Design Project / Capstone Project - I	-	3.00	1.50	CSE-105, CSE-203, CSE-215, CSE-205 and their corresponding sessionals, CSE-220*
	Total		**15.00**	**9.00**	**19.50**	

*Note: In respect of prerequisite course(s) for taking IDP-I, HOD may alow waiver of maximum two courses.

*LEVEL-3 INDUSTRIAL TRAINING

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
	CSE-350	Industrial Training	-	4 Weeks	1.00	

***Note:** This course is mandatory. Evaluation report from industry is to be submitted at the end of the training and accordingly to be incorporated in the tabulation sheet.

LEVEL-4 TERM-I

	Course No	Course Title	Hours/Week		Credits	Remarks
			Theory	Sessional		
1.	CSE-400	Thesis	-	3.00	1.50	
2.	CSE-401	Information System Design and Development	3.00	-	3.00	
3.	CSE-402	Information System Design and Development Sessional		1.50	0.75	
4.	CSE-403	Artificial Intelligence	3.00	-	3.00	
5.	CSE-404	Artificial Intelligence Sessional	-	1.50	0.75	
6.	HUM-415	Financial and Managerial Accounting	2.00	-	2.00	
7.	CSE-405	Computer Interfacing	3.00		3.00	
8.	CSE-460	Integrated Design Project / Capstone Project – II		6.00	3.00	CSE-360
9.	CSE-4XO	Option-II	3.00	-	3.00	
	Total		**14.00**	**12.00**	**20.00**	

Option-II

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
4.	CSE-407	Applied Statistics and Queuing Theory	3.00	-	3.00	
5.	CSE-419	Advanced Algorithms	3.00	-	3.00	
6.	CSE-421	Basic Graph Theory	3.00	-	3.00	
7.	CSE-423	Fault Tolerant System	3.00	-	3.00	
8.	CSE-425	Basic Multimedia Theory	3.00	-	3.00	
9.	CSE-427	Digital Image Processing	3.00	-	3.00	
10.	CSE-431	Object Oriented Software Engineering	3.00	-	3.00	
11.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00	-	3.00	
12.	CSE-435	Distributed Algorithms	3.00	-	3.00	
13.	CSE-437	Bioinformatics	3.00	-	3.00	
14.	CSE-439	Robotics	3.00	-	3.00	
15.	CSE-447	Telecommunication Engineering	3.00	-	3.00	

LEVEL-4 TERM-II

	Course No	Course Title	Hours/Week		Credits	Remarks
			Theory	Sessional		
1.	CSE-400	Thesis	-	6.00	3.00	
2.	CSE-413	Computer Graphics	3.00	-	3.00	
3.	CSE-414	Computer Graphics Sessional	-	1.50	0.75	
4.	HUM-417	Engineering Management and Ethics	3.00	-	3.00	
5.	CSE-429	Computer Security	3.00	-	3.00	
6.	CSE-415	Human Computer Interaction	3.00	-	3.00	
7.	CSE-416	Human Computer Interaction Sessional	-	1.50	0.75	
8.	CSE-4XO	Option-III	3.00		3.00	
9.	CSE-4XE	Option-III Sessional	-	1.50	0.75	
	Total		**15.00**	**10.50**	**20.25**	

Option-III

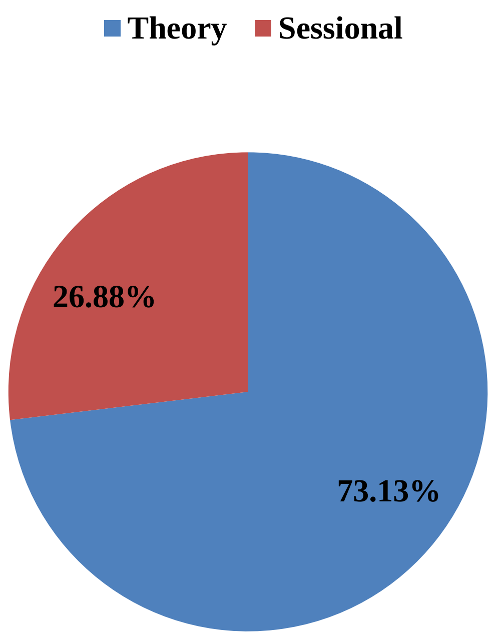
	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-411	VLSI Design	3.00	-	3.00	
2.	CSE-412	VLSI Design Sessional	-	1.50	0.75	
3.	CSE-441	Machine Learning	3.00	-	3.00	
4.	CSE-442	Machine Learning Sessional	-	1.50	0.75	
5.	CSE-443	Pattern Recognition	3.00	-	3.00	
6.	CSE-444	Pattern Recognition Sessional	-	1.50	0.75	
7.	CSE-445	Digital Signal Processing	3.00	-	3.00	
8.	CSE-446	Digital Signal Processing Sessional	-	1.50	0.75	
9.	CSE-449	Mobile and Ubiquitous Computing	3.00	-	3.00	
10.	CSE-450	Mobile and Ubiquitous Computing Sessional	-	1.50	0.75	
11.	CSE- 451	Simulation and Modeling	3.00	-	3.00	
12.	CSE- 452	Simulation and Modeling Sessional	-	1.50	0.75	
13.	CSE- 453	Data Ware-housing and Data Mining	3.00	-	3.00	
14.	CSE-454	Data Ware-housing and Data Mining Sessional	-	1.50	0.75	
15.	CSE-455	Natural Language Processing	3.00	-	3.00	
16.	CSE-456	Natural Language Processing Sessional	-	1.50	0.75	
17.	CSE-457	Advanced Database Systems	3.00	-	3.00	
18.	CSE-458	Advanced Database Systems Sessional	-	1.50	0.75	

Note: The courses that have been eliminated in the reviewed syllabus may be offered as deemed necessary due to failed or not registered in these courses in previous terms by any student.

Summery

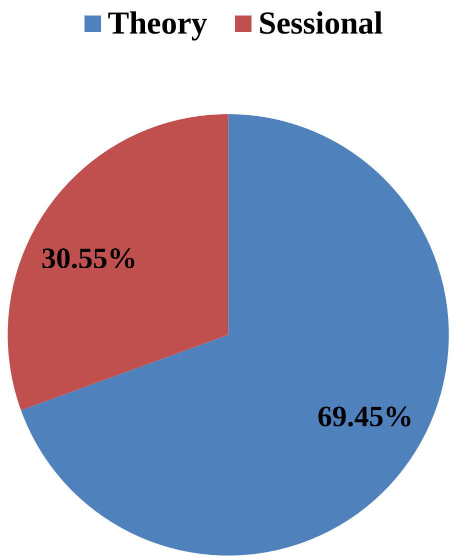
Summary of Departmental, Non-departmental, Basic Science and Humanities Theory and Sessional Courses								
Level and Term	**Hours/Week**		**Total Cont. Hours**	**Credits**		**Total Credits**	**No of Courses**	
	Theory	**Sessional**		**Theory**	**Sessional**		**Theory**	**Sessional**
Level-1 Term-I	13.00	12.00	25.00	13.00	6.00	19.00	5	5
Level-1 Term-II	15.00	9.00	24.00	15.00	4.50	19.50	5	3
Level-2 Term-I	15.00	10.50	25.50	15.00	5.25	20.25	5	4
Level-2 Term-II	14.00	12.00	26.00	14.00	6.00	20.00	5	5
Level-3 Term-I	16.00	9.00	25.00	16.00	4.50	20.50	5	4
Level-3 Term-II	15.00	9.00	24.00	15.00	5.50	20.50	5	4
Level-4 Term-I	14.00	12.00	26.00	14.00	6.00	20.00	5	4
Level-4 Term-II	15.00	10.50	25.50	15.00	5.25	20.25	5	4
Grand Total	**117.00**	**84.00**	**201.00**	**117.00**	**43.00**	**160.00**	**40**	**33**

<u>**Pie Chart**</u>



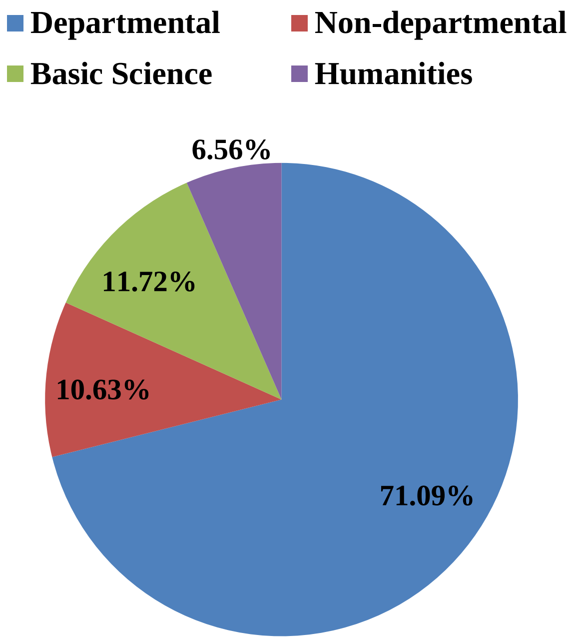
Summary of Departmental Theory and Sessional Courses			
Level/ Term	**Theory**	**Sessional**	**Total**
Level-1 Term-I	0.00	1.50	1.50
Level-1 Term-II	6.00	1.50	7.50
Level-2 Term-I	9.00	4.50	13.50
Level-2 Term-II	9.00	6.00	15.00
Level-3 Term-I	16.00	4.50	20.50
Level-3 Term-II	15.00	5.50	20.50
Level-4 Term-I	12.00	6.00	18.00
Level-4 Term-II	12.00	5.25	17.25
Total	**79.00**	**34.75**	**113.75**

<u>Pie Chart</u>



Summary of Departmental, Non-departmental, Basic Science and Humanities Courses					
Level/ Term	**Departmental**	**Non Departmental**	**Basic Science**	**Humanities**	**Total**
Level-1 Term-I	1.50	7.25	6.75	3.50	19.00
Level-1 Term-II	7.50	6.00	6.00	0.00	20.00
Level-2 Term-I	13.50	3.75	3.00	0.00	20.25
Level-2 Term-II	15.00	0.00	3.00	2.00	20.25
Level-3 Term-I	20.50	0.00	0.00	0.00	20.50
Level-3 Term-II	20.50	0.00	0.00	0.00	20.50
Level-4 Term-I	18.00	0.00	0.00	2.00	20.00
Level-4 Term-II	17.25	0.00	0.00	3.00	20.25
	113.75	**17.00**	**18.75**	**10.50**	**160.00**

Pie Chart



CHAPTER 5

DETAIL OUTLINE OF INDERGRADUATE COURSES OFFERED BY THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LEVEL-1 TERM-I

CSE-100 — 3 hours in a week, 1.50 Cr.

Introduction to Computer Systems Sessional

Pre-requisite: None

Rationale:

To introduce with the most recent technology and to teach students the basic concepts of computer programming.

Objective:

1. To introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
2. To provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint.
3. To provide knowledge on the fundamentals of writing Python scripts.

Course Outcomes (COs):

Upon completion of the course, the students will be able to:

1. Recognize the most-up-to-date technology in an ever-changing discipline.
2. Demonstrate the fundamentals of computers and computer nomenclature, particularly with respect to personal computer hardware and software, the Web, and enterprise computing.
3. Learn a handful of various Python advanced topics including high level data structures, network programming.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz, Online Test.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Recognize the most-up-to-date technology in an ever-changing discipline.												√
Demonstrate the fundamentals of computers and computer nomenclature, particularly with respect to personal computer hardware and software, the Web, and enterprise computing.										√		
Learn a handful of various Python advanced topics including high level data structures, network programming.					√							

Lecture Schedule:

Week	Lecture	Topics
1	Lab 1	MS Word 2010, MS Excel 2010, MS Power Point 2010, Making a Good Power Point Presentation, Grouping for Presentation, Selection of Topics for P esentation
2	Lab 2	Introduction to Computations, History of Computing Devices, Identification of Hardware Parts of PC (Monitor HDD, FDD, CDROM, Data Cord, Motherboard, Microprocessor, Cooling Fan, BIOS Battery, RAM, BIOS Chip, Ports, Keyboard, Mouse etc.)
3	Lab 3	Assemble of Hardware (Starts from Processor Connection to Full Computer Assembling) and Trouble Shootings
4	Lab 4	**Practical Exam** on Lab 02, 03 (Hardware Parts)
5	Lab 5	Introduction to Python, Data Types, Variables, Indentation, Comment, Basic Input/ Output, Naming Convention, Operators and Expressions in Python
6	Lab 6	Decision Control Statement, Loop Control Statements in Python
7	Lab 7	Lists in Python, Manipulating Strings in Python
8	Lab 8	Function and Recursion in Python, Keyword and Optional Parameters, Lambda, Inner Functions, Modules
9	Lab 9	Introduction to OOP, Classes in Python, Regular Expressions, Writing GUIs in Python
10	Lab 10	Python and CGI Scripts, The OS Module, Network Programming
11	Lab 11	Synchronization, Data Compression, Python and Databases
12	Lab 12	Exception Handling, Bit Manipulation, Number System: Binary, Octal, Decimal and Hexadecimal Systems, Flow Charts
13	Lab 13	**Online Exam**
14	Lab 14	**Quiz+ Group Presentation**

Reference Book (s):

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

3 hours in a week, 3.00 Cr.

EECE-163

Electrical Circuit Analysis

Pre-requisite: None

Rationale:

To understand the behavior of linear electric circuits in their different regimes: direct current, alternating current and transient state.

Objective:

1. To understand basic concepts of DC and AC circuit behavior.
2. To develop and solve mathematical representations for simple RLC circuits.
3. To understand the use of circuit analysis theorems and methods.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify how to develop and employ circuit models for elementary electrical components, e.g. resistors, sources, inductors, capacitors etc.
2. Analyze to use various methods of circuit analysis both for DC and AC networks.
3. Identify the different aspects of linear and non-linear electrical circuits.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify how to develop and employ circuit models for elementary electrical components, e.g. resistors, sources, inductors, capacitors etc.			√									
Analyze to use various methods of circuit analysis both for DC and AC networks.		√										
Identify the different aspects of linear and non-linear electrical circuits.		√										

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Fundamental electrical concepts and measuring units	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Direct current (dc): Current, voltage, resistance, power and energy	
3	Lec 7 Lec 8 Lec 9	Series Circuits	
4	Lec 10 Lec 11 Lec 12	Parallel Circuits	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Methods of network analysis and Network Theorems	
6	Lec 16 Lec 17 Lec 18	Capacitors and Inductors	
7	Lec 19 Lec 20 Lec 21	Introduction to magnetic circuits	
8	Lec 22 Lec 23 Lec 24	Alternating current (ac): Instantaneous current and voltage for various combinations of R, L and C circuits	**Class Test 3**

9	Lec 25 Lec 26 Lec 27	Alternating current (ac): Instantaneous power for various combinations of R, L and C circuits	
10	Lec 31 Lec 32 Lec 33	Effective current and voltage, average power	
11	Lec 28 Lec 29 Lec 30	Phasor representation of sinusoidal quantities Sinusoidal	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Single-Phase Circuit Analysis	
13	Lec 37 Lec 38 Lec 39	Introduction to three phase circuits	
14	Lec 40 Lec 41 Lec 42	Power factor and power equation (Δ and Y circuits).	

Reference Book (s):

1. Introductory Circuit Analysis (12^{th} ed)- Robert L. Boylestad, Pearson Education India (2013).
2. Alternating Current Circuits (3^{rd} ed) - Russel M Kerchner and George F Corcoran, J. Wiley & Sons Inc. (1951).
3. Fundamentals of Electric Circuits (6^{th} ed)- Charles K Alexander, Mathew N O Sadiku, McGraw-Hill Education (2016).
4. Introduction to Electric Circuits (6^{9h} ed)- Richard C. Dorf, James A. Svoboda, Wiley (2013).

EECE-164 — 3 hours in a week, 1.50 Cr.

Electrical Circuit Analysis Sessional

Pre-requisite: None

Rationale:

To perform several experiments to verify practically the theories and concepts learned and understand the difference between theory and application.

Objective:

1. To understand the basic electrical engineering principles and abstractions on which the design of electronic systems is based.
2. To analyze and design simple electronic circuits.
3. To understand the relationship between the mathematical representation of circuit behavior and corresponding real-life effects.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Recognize how to develop and employ circuit models for elementary electrical components, e.g. resistors, sources, inductors, capacitors etc.
2. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Compare to use various methods of circuit analysis both for DC and AC networks and their solution methods.
4. Appraise the characteristics of different electronic devices.

Course Content:

Construction and operation of simple electrical circuits, verification of KVL, verification of KCL, verification of superposition principle, verification of Thevenin's theorem, familiarization with Alternating Current (Ac) waves, study of R-L-C series circuit, different types of filters and its characteristics with different input frequency, series resonance and parallel resonance.

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment/Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Recognize how to develop and employ circuit models for elementary electrical components, e.g. resistors, sources, inductors, capacitors etc.						√						
Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.						√						
Compare to use various methods of circuit analysis both for DC and AC networks and their solution methods.							√					
Appraise the characteristics of different electronic devices.							√					

Lecture Schedule:

Week	Lecture	Topics
1	Lab 1	Construction & Operation of Simple Electrical Circuits
2	Lab 2	Verification of KVL
3	Lab 3	Verification of KCL
4	Lab 4	Verification of Superposition Theorem
5	Lab 5	Verification of Thevenin's Theorem
6	Lab 6	**Lab Test- 01**
7	Lab 7	Familiarization with alternating current (ac) waves
8	Lab 8	Study of R-L-C series circuit
9	Lab 9	Different types of filters and its characteristics with different input frequency
10	Lab 10	Series Resonance and Parallel Resonance
11	Lab 11	**Lab Test- 02**
12	Lab 12	**Quiz**
13 + 14	Lab 13 + 14	**Viva**

Reference Book (s):

1. Introductory Circuit Analysis (12^{th} ed)- Robert L. Boylestad, Pearson Education India (2013).
2. Alternating Current Circuits (3^{rd} ed) - Russel M Kerchner and George F Corcoran, J. Wiley & Sons Inc. (1951).
3. Fundamentals of Electric Circuits (6^{th} ed)- Charles K Alexander, Mathew N O Sadiku, McGraw-Hill Education (2016).
4. Introduction to Electric Circuits (6^{9h} ed)- Richard C. Dorf, James A. Svoboda, Wiley (2013).

2 hours in a week, 2.00 Cr.

ME-181

Basic Mechanical Engineering

Pre-requisite: None

Rationale:

To introduce the fundamentals of Mechanical Engineering, as well as providing a brief introduction to Materials Science.

Objective:

1. To introduce the core mechanical engineering concepts of design and mechanisms, intelligent systems, applied materials and fluid machinery.
2. To provide knowledge of the role of Mechanical Engineers and how the subject is applied.
3. To understand a range of machining and manufacturing processes required to make mechanical components.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate use of engine, mechanism and different parts.
2. Determine Kinematics of particles and rigid bodies.
3. Identify working principles of refrigeration, air condition system, and its effectiveness.
4. Express and apply the relative motion and law of motion.

Course Content:

Sources of energy: conventional and renewable; Introduction to IC engines, Refrigeration and Air conditioning systems; Statics of particles and rigid bodies; Forces in trusses and frames; Relative motion; Kinematics of particles: Newton's Second Law of Motion;

Kinematics of rigid bodies; Introduction to Robotics; Plane, rotational and spatial motion with applications to manipulators; Geometric configurations: structural elements, linkage, arms and grippers; Motion characteristics. Note: Students may be exposed to the relevant machine through demonstration in the laboratory where applicable.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate use of engine, mechanism and different parts.	√											
Determine Kinematics of particles and rigid bodies.	√											
Identify working principles of refrigeration, air condition system, and its effectiveness.	√											
Appraise the relative motion and law of motion.		√										

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Sources of energy: conventional and renewable	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Introduction to IC engines	
3	Lec 7 Lec 8 Lec 9	Introduction to Refrigeration and Air conditioning systems	
4	Lec 10 Lec 11 Lec 12	Statics of particles and rigid bodies	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Forces in trusses and frames	
6	Lec 16 Lec 17 Lec 18	Relative motion	
7	Lec 19 Lec 20 Lec 21	Kinematics of particles: Newton's Second Law of Motion	
8	Lec 22 Lec 23	Kinematics of rigid bodies	**Class Test 3**

	Lec 24		
9	Lec 25 Lec 26 Lec 27	Introduction to Robotics	
10	Lec 31 Lec 32 Lec 33	Plane, rotational motion with applications to manipulators	
11	Lec 28 Lec 29 Lec 30	Spatial motion with applications to manipulators	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Geometric configurations: structural elements, linkage	
13	Lec 37 Lec 38 Lec 39	Geometric configurations: arms and grippers	
14	Lec 40 Lec 41 Lec 42	Motion characteristics	

Reference Book (s):

1. A Textbook of Thermal Engineering- R S Khurmi, S. Chand Publisher (2006).
2. Introduction to Thermal Engineering- J. P. Vasandani.
3. Refrigeration and Air Conditioning (1st ed)- Ahmadul Ameen, PHI Learning 0 (2006).

MATH-141 — 3 hours in a week, 3.00 Cr.

Mathematics-I (Differential Calculus and Integral Calculus)

Pre-requisite: None

Rationale:

To provide an understanding of the basic concepts of differential and integral calculus.

Objective:

1. To learn the concepts of the derivative and its underlying concepts such as limits and continuity.

2. To learn to calculate derivative for various type of functions using definition and rules.
3. To provide knowledge on using concept of integration to evaluate geometric area and solve other applied problems.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Determine the rate of change of shape of different standard particles.
2. Analyze and calculate the extreme values of functions.
3. Determine the trend of change of a function with respect to different independent variables.
4. Differentiate the techniques of evaluating indefinite and definite integrals.

Course Content:

Differential Calculus: Introduction to Differential Calculus, Limit, continuity and differentiability, successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem, Mean value theorem, expansion in finite and infinite forms, Lagrange's form of remainder, Cauchy's form of remainder, indeterminate form, Partial differentiation, Euler's theorem, tangent and normal, sub tangent and subnormal in Cartesian and polar coordinates, maxima and minima of functions of single variables, curvature, asymptotes.

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Determine the rate of change of shape of different standard particles.	√											
Analyze and calculate the extreme values of functions.		√										
Determine the trend of change of a function with respect to different independent variables.				√								

Differentiate the techniques of evaluating indefinite and definite integrals.	√											

Lecture Schedule:

<table>
<tr><th>Week</th><th>Lecture</th><th>Topics</th><th>Class Test</th></tr>
<tr><td>1</td><td>Lec 1
Lec 2
Lec 3</td><td>Introduction to Differential Calculus, Limit, continuity and differentiability</td><td rowspan="3">Class Test 1</td></tr>
<tr><td>2</td><td>Lec 4
Lec 5
Lec 6</td><td>Successive differentiation of various types of functions, Leibnitz’s theorem</td></tr>
<tr><td>3</td><td>Lec 7
Lec 8
Lec 9</td><td>Rolle’s theorem, Mean value theorem, expansion in finite and infinite forms</td></tr>
<tr><td>4</td><td>Lec 10
Lec 11
Lec 12</td><td>Lagrange’s form of remainder, Cauchy’s form of remainder</td><td rowspan="4">Class Test 2</td></tr>
<tr><td>5</td><td>Lec 13
Lec 14
Lec 15</td><td>Indeterminate form, Partial differentiation Euler’s theorem, tangent and normal</td></tr>
<tr><td>6</td><td>Lec 16
Lec 17
Lec 18</td><td>Sub tangent and subnormal in Cartesian and polar coordinates</td></tr>
<tr><td>7</td><td>Lec 19
Lec 20
Lec 21</td><td>Maxima and minima of functions of single variables, curvature, asymptotes</td></tr>
<tr><td>8</td><td>Lec 22
Lec 23
Lec 24</td><td>Introduction to integral calculus, Methods of integration: integration by the method of substitution</td><td rowspan="3">Class Test 3</td></tr>
<tr><td>9</td><td>Lec 25
Lec 26
Lec 27</td><td>Integration by parts, standard integrals, integration by the method of successive reduction</td></tr>
<tr><td>10</td><td>Lec 31
Lec 32
Lec 33</td><td>Definite integrals: Evaluation of definite integrals, properties of definite integral and its use,</td></tr>
<tr><td>11</td><td>Lec 28
Lec 29
Lec 30</td><td>Summing series, Walli’s formula, improper integrals, double integral</td><td rowspan="4">Class Test 4</td></tr>
<tr><td>12</td><td>Lec 34
Lec 35
Lec 36</td><td>Beta function and Gamma function, double integral</td></tr>
<tr><td>13</td><td>Lec 37
Lec 38
Lec 39</td><td>Multiple integral with its application, Application of integration: length of curves, area under a plane curve</td></tr>
<tr><td>14</td><td>Lec 40
Lec 41
Lec 42</td><td>Area of the region enclosed by two curves, volume of solid of revolution</td></tr>
</table>

Reference Book (s):

1. Calculus - Haward Anton (9^{th} ed)- Stephen Davis, Wiley (2012).
2. Differential and Integral Calculus (5^{th} ed)- Matin Chakraborty, Dhaka Standard Publication (2015).
3. A Text Book on Integral Calculus (4^{th} ed)- Mohammad, Bhattacharjee & Latif, Dhaka (2010).

PHY-103 3 hours in a week, 3.00 Cr.

Physics

Pre-requisite: None

Rationale:

To able to use the understanding to predict how an object will behave under particular conditions and to help improving the functionalities of everyday objects.

Objective:

1. To identify and solve engineering problems from unusually broad physical perspectives.
2. To provide knowledge of using engineering and communications skills in other areas such as research, consulting, law, medicine, business, public policy, etc.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify the basic knowledge of different areas of physics as well as engineering aspect.
2. Recognize the modern physics related to Computer Science.
3. Illustrate knowledge of problem-solving techniques, skill and analyzing data.

Course Content:

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

Optics and Laser: Theories of light: Interference of light, Young's double slit experiment, Fresnel's biprism. Interference in thin films, Newton's rings, Interferometers, Diffraction of light: Fresnel and Fraunhofer diffractions, Diffraction by single slit, diffraction by double slits, diffraction gratings, Resolving power of optical instruments, Polarization of light: production and analysis of polarized light, polarization by double refraction, Brewster's law, Malus law, Nicole prism, optical activity and polarimeter. Laser, spontaneous and stimulated emission, Helium-Neon laser, laser applications, Fiber optics.

Electricity & Magnetism: Coulomb's law, electric field, Gauss' law and its application, electric potential, capacitors and capacitance, dielectrics, dielectric and Gauss's law, Ohm's law, resistivity -an atomic view, current density and drift velocity, Ampere's law, Faraday's law; Lenz's law, self-inductance and mutual inductance, Magnetization, Susceptibility, permeability, classification of magnetic materials, hysteresis loop, soft and hard magnetic materials.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify the basic knowledge of different areas of physics as well as engineering aspect.	√											
Recognize the modern physics related to Computer Science.					√							
Illustrate knowledge of problem-solving techniques, skill and analyzing data.		√										

Lecture Schedule:

Week	**Lecture**	**Topics**	**Class Test**
1	Lec 1 Lec 2 Lec 3	Differential equation of simple harmonic oscillator, total energy and average energy	
2	Lec 4 Lec 5 Lec 6	Combination of simple harmonic oscillations, spring-mass system, damped oscillation, forced oscillation	**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Resonance, stationary wave, phase velocity, group velocity	

4	Lec 10 Lec 11 Lec 12	Wave motion, wave energy, Theories of light: Interference of light, Young's double slit experiment	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Fresnel's biprism. Interference in thin films, Newton's rings, Interferometers	
6	Lec 16 Lec 17 Lec 18	Diffraction of light: Fresnel and Fraunhofer diffractions, Diffraction by single slit, diffraction by double slits, diffraction gratings	
7	Lec 19 Lec 20 Lec 21	Resolving power of optical instruments, Polarization of light: production and analysis of polarized light, polarization by double refraction	
8	Lec 22 Lec 23 Lec 24	Brewster's law, Malus law, Nicole prism, optical activity and polarimeter	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Laser, spontaneous and stimulated emission, Helium-Neon laser, laser applications, Fiber optics	
10	Lec 31 Lec 32 Lec 33	Electricity & Magnetism: Coulomb's law, electric field, Gauss' law and its application	
11	Lec 28 Lec 29 Lec 30	Electric potential, capacitors and capacitance, dielectrics, dielectric and Gauss's law	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Ohm's law, resistivity -an atomic view, current density and drift velocity	
13	Lec 37 Lec 38 Lec 39	Ampere's law, Faraday's law; Lenz's law, self-inductance and mutual inductance	
14	Lec 40 Lec 41 Lec 42	Magnetization, Susceptibility, permeability, classification of magnetic materials, hysteresis loop, soft and hard magnetic materials	

Reference Book(s):

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

PHY-104 **1.50 hours in a week, 0.75 Cr.**

Physics Sessional

Pre-requisite: None

Rationale:

To perform experiments to verify practically the theories and concepts learned and understand the difference between theory and application.

Objective:

1. To help learning how to be patient and careful while taking observation.
2. To provide knowledge on how to develop the ability of the students to conduct, observe, analyze and report an experiment.
3. To help to deal with physical models and formulas mathematically.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate an ability to make physical measurements and understand the limits of precision in measurements.
2. Demonstrate the ability to use experimental statistics to determine the precision of a series of measurements.
3. Compare to use various methods of circuit analysis both for DC and AC networks and their solution methods.
4. Appraise the characteristics of different electronic devices.

Course Content:

Determination of specific resistance of a wire using a meter bridge, determination of the resistance per unit length of meter bridge wire, determination of mechanical equivalent (J) of heat by the electrical method, determination of electrochemical equivalent (ECE) of copper by the cooper Voltammeter, determination of resistance of a galvanometer by half deflection method, determination of high resistance by the method of deflection, determination of focal length of a concave lens by auxiliary lens method, determination of radius of a curvature of a Plano convex lens by Newton’s ring method, determination of the refractive index of the material of a prism by spectrometer, determination of the specific rotation of sugar solution by Polarimeter, determination of frequency of a tuning fork by the Melde’s experiment, determination of the spring constant and the effective mass of a loaded spring and hence to calculate the rigidity modulus of the spring, determination of the value of g acceleration due to gravity by means of a compound pendulum, determination of Young’s modulus of a bar by bending method, determination of the modulus of rigidity of a wire by statistical method.

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment/Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate an ability to make physical measurements and understand the limits of precision in measurements.						√						
Demonstrate the ability to use experimental statistics to determine the precision of a series of measurements.						√						
Illustrate properties of a variety of electrical and optical systems.						√						

Lecture Schedule:

Week	Lecture	Topics
1+ 2	Lab 1+ 2	Determination of specific resistance of a wire using a meter bridge, determination of the resistance per unit length of meter bridge wire, determination of mechanical equivalent (J) of heat by the electrical method
3+ 4	Lab 3+ 4	Determination of electrochemical equivalent (ECE) of copper by the cooper Voltammeter, determination of resistance of a galvanometer by half deflection method,

		determination of high resistance by the method of deflection
5+ 6	Lab 5+ 6	Determination of focal length of a concave lens by auxiliary lens method, determination of radius of a curvature of a Plano convex lens by Newton's ring method, determination of the refractive index of the material of a prism by spectrometer
7+ 8	Lab 7+ 8	Determination of the specific rotation of sugar solution by Polarimeter, determination of frequency of a tuning fork by the Melde's experiment, determination of the spring constant and the effective mass of a loaded spring and hence to calculate the rigidity modulus of the spring
9+ 10	Lab 9+ 10	Determination of the value of g acceleration due to gravity by means of a compound pendulum, determination of Young's modulus of a bar by bending method, determination of the modulus of rigidity of a wire by statistical method
11+ 12	Lab 11+ 12	**Lab Test**
13	Lab 13	**Quiz**
14	Lab 14	**Viva**

Text and Ref Books:

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

HUM-101 **2 hours in a week, 2.00 Cr.**

Developing English Language Skills 1

Pre-requisite: None

Rationale:

To provide fundamental knowledge on how to improve spoken English skills and to enable to write more effectively in English.

Objective:

1. To give the students exposure to different types of texts in English in order to make them informed and critical reader.
2. To gain an understanding of the underlying writing well-organized paragraphs and also to teach how to edit and revise their own as well as peer's writing.
3. To teach grammar and vocabulary in a contextualized way.
4. To teach how to write formal letters for a range of academic purposes.
5. To develop skills to communicate effectively and professionally.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Students will develop their reading skills through various reading techniques which will enable them to understand, analyze and evaluate reading texts.
2. By practicing writing different types of paragraphs, students are going to acquire a good command over structure and techniques of paragraph writing.
3. Vocabulary and grammatical structure from extensive reading will help to develop student's ability to express themselves through writing for academic and other purposes.
4. Students will acquire skills in summarizing, paraphrasing, synthesizing and explaining information from different sources.
5. Employ strategies of pre-writing, drafting, and revising, taking into consideration rhetorical purpose, the knowledge and needs of varied writing contexts, and the feedback of instructors and peers.
6. Demonstrate the knowledge of genre conventions and structure (e.g., introductions, paragraphing, transitions) in ways that serve the development and communication of information and ideas.
7. Edit such that choices in style, grammar, spelling, and punctuation contribute to the clear communication of information and ideas.
8. Reflect on what contributed to their writing process and evaluate their own and their peers' work.
9. Become an academic writer and critic of any text written in English.
10. Participate successfully in the discourse of the specific community and beyond.

Course Content:

Reading: Reading techniques: scanning, skimming, predicting, inference, analysis, summarizing and interpretation of texts; Academic reading: comprehension from subject related passages, article reading, research paper reading, newspaper reading, reading selected short stories, Reading for book review, report review, case study review, Reading from departmental text for literature review.

Writing: Introductory discussion on writing, prewriting, drafting, topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event, paragraph writing, Compare-contrast and cause- effect paragraph, Essay writing: writing steps, principles and techniques, outlining, revising, editing, proofreading etc., narrative and descriptive essays, comparison-contrast and cause – effect essays, argumentative essay, summary, paraphrase, E-mail, Report: purpose of a report, classification of report, organizing a report, writing short report, analysis and illustration of report, problems in writing reports, term paper writing: introduction to writing of a term paper and its methodologies.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Students will develop their reading skills through various reading techniques which will enable them to understand, analyze and evaluate reading texts.	√											
By practicing writing different types of paragraphs, students are going to acquire a good command over structure and techniques of paragraph writing.	√											
Vocabulary and grammatical structure from extensive reading will help to develop student's ability to express themselves through writing for academic and other purposes.		√										
Students will acquire skills in summarizing, paraphrasing, synthesizing and explaining information from different sources.	√											
Employ strategies of pre-writing, drafting, and revising, taking into consideration rhetorical purpose, the knowledge and needs of varied writing contexts, and the feedback of instructors and peers.			√									

Demonstrate the knowledge of genre conventions and structure (e.g., introductions, paragraphing, transitions) in ways that serve the development and communication of information and ideas.		√										
Edit such that choices in style, grammar, spelling, and punctuation contribute to the clear communication of information and ideas.		√										
Reflect on what contributed to their writing process and evaluate their own and their peers' work.			√									
Become an academic writer and critic of any text written in English.				√								
Participate successfully in the discourse of the specific community and beyond.			√									

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2	Introduction to Language, Methodologies/Approaches of English Teaching-Learning Process	**Class Test 1**
2	Lec 3 Lec 4	Introduction to Phonetics, IPA Transcription and variation of accents	
3	Lec 5 Lec 6	Types of Sentences, Introduction to Tense	
4	Lec 7 Lec 8	Use of Main Verbs, Auxiliaries	**Class Test 2**
5	Lec 9 Lec 10	Modals & Semi modals, Causatives, Conditionals	
6	Lec 11 Lec 12	Active / Passive Sentences, Forming Questions	
7	Lec 13 Lec 14	Adverbs and Adverb related structures	
8	Lec 15 Lec 16	Problems with Adjectives, Conjunction, Prepositions	**Class Test 3**
9	Lec 17 Lec 18	Reading: Skimming, and Scanning	
10	Lec 19 Lec 20	Reading Comprehension, Selected short Stories	
11	Lec 21 Lec 22	Writing: Writing Strategies. General Correspondence & Communication/Tech	**Class Test 4**
12	Lec 23 Lec 24	Writing: Introduction to General Correspondence	
13	Lec 25 Lec 26	Formal Communication	
14	Lec 27 Lec 28	Report Writing, how to write a curriculum vitae	

Text and Ref Books:

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

3 hours in a week, 1.50 Cr.

HUM-102

Developing English Language Skills II

Pre-requisite: None

Rationale:

To help to improve spoken English skills and to enable to communicate more effectively in English.

Objective:

1. To improve students' oral communication skills to communicate accurately in various situations;
2. To provide instructions and necessary guideline to practice in general, classroom and real life conversation while engaging students in different kind of speaking activities;
3. To develop students' interpersonal skills engaging them in various group interactions and activities;
4. To help students to overcome their inhibitions, shyness and nervousness in speaking;
5. To practice and improve students' listening skills;
6. To improve students' pronunciation in order to improve their level of comprehensibility in both speaking and listening;
7. To strengthen students' presentation skills to prepare them for different kinds of public speaking;
8. To strengthen students' self-evaluation skills to monitor and develop their own language progress and initiate self-improvement;
9. To encourage a positive attitude towards the language and to develop students' self-confidence.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Communicate in wide range of situation;
2. Comprehend any kinds of speech efficiently that they listen to;
3. Improve their pronunciation;
4. Give formal presentation;
5. Respond in English to any expected and unexpected situations;
6. Produce effective speech in various interactions.

Course Content:

- Introducing yourself and others; using greetings, Describing people/place/things;
- Asking and answering questions, Expressing likings and disliking; (food, fashion etc.)
- Discussing everyday routines and habits, Making requests/offers/invitations/ excuses/apologies/complaints, Asking and giving directions;
- Describing personality, discussing and making plans(for a holiday or an outing to the cinema)
- Reading Newspapers and presenting their opinions
- Practicing storytelling, Narrating personal experiences
- Introducing presentation skills
- Extempore talk
- Telephone conversations (role play in group or pair)
- Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)
- Problem solving, peer interviews/job interviews
- Summarizing movies/books and describing various aspects or parts of these (character description, conflict of the movie, resolution of the book)
- Debate and put forward an argument
- Selected stories for presentation

Activities: this course is mostly activity based. Students will often be engaged in interactive discussion. The tasks and activities include **pair work, group work, brainstorming, guesswork, describing picture/graph/diagrams, word puzzle, making jokes, storytelling, role play, responding to reading and listening texts.**

Teaching-learning and Assessment Strategy:

Speaking, Presentation, Report Writing, Group Discussion, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Speaking	25
Presentation	25
Report Writing	20
Quiz/ Viva	10
Class Participation	10
Group Discussion	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Communicate in wide range of situation;						√						
Comprehend any kinds of speech efficiently that they listen to;						√						
Improve their pronunciation;							√					
Give formal presentation;						√						
Respond in English to any expected and unexpected situations;								√				
Produce effective speech in various interactions.							√					

Lecture Schedule:

Week	Lecture	Topics
1	Lab 1	Introduction to Language: Introducing basic skills of language; Phonetics, English Vowel and consonant sounds, Difference between different accents
2	Lab 2	Self-Introduction, how a speaker should introduce himself; Situational talks / dialogues
3	Lab 3	Speaking: IELTS speaking - Part 1, 2 & 3
4	Lab 4	Public Speaking: Basic elements of good presentation or public speaking, some tips for good speech.
5	Lab 5	**Speaking Test**
6	Lab 6	**Group discussion**, taking participation in any discussion and drawing conclusion and giving recommendation
7	Lab 7	Brain storming: Principles of brain storming. How to think logically; Facing any problem, trying to find out possible solutions, drawing conclusion and giving recommendation
8	Lab 8	Individual / Group presentation, good presentation skills; Skimming, Scanning & Analytical Ability, techniques of skimming, scanning and generating ideas through purpose reading
9	Lab 9	Reading: Introducing IELTS academic reading comprehension,
10	Lab 10	Academic Writing: Introducing IELTS academic writing, **Report Writing**

11	Lab 11	Listening and understanding, note taking and answering questions
12	Lab 12	Listening: Introducing IELTS / TOEFL listening section
13	Lab 13	**Group Presentation**
14	Lab 14	**Quiz/ Viva**

Text and Ref Books:

1. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
2. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation)
3. Materials provided by the instructor.

1.50 hours in a week, 0.75 Cr.

SHOP-140

Workshop Practice Sessional

Pre-requisite: None

Rationale:
To provide instructions and practical experience in basic mechanical workshop methods, manufacturing process, tools and machines.

Objective:
1. To introduce to the basic operations of bench fitting tools.
2. To familiarize with the various types of manual machines and introduce them to different operation of machining.
3. To learn about different types of molding.
4. To know about various types of Welding and introduce them to different type of welding joints.
5. To provide knowledge on different tools of woodshop and make them familiar with different type of wood joints.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Identify how to work in workshop environments.
2. Organize practical work in the engineering workshop in various environments.
3. Demonstrate practical knowledge to produce engineering works like- foundry, carpentry, welding etc.

Course Content:
Foundry: Introduction to foundry, tools and equipment; Patterns: function, pattern making; Molding: molding materials sand preparation, types of mold, procedure; Cores: types, core making materials; Metal melting and casting; Inspection of casting and casting

defects. Welding: Metal joints, riveting, grooving, soldering, welding; Welding practice: electric arc steel, aluminum; Types of electrode; Welding defects: visual, destructive and non-destructive tests of welding. Gas welding and equipment; Types of flame; Welding of different types of material; Gas welding defects; Test of gas welding. Carpentry: Wood working tools, Wood working machine, Band Saw, Scroll Saw, Circular Saw, Jointer, Thickness Planner, Disc Sander, Wood Lathe, Types of Sawing, Common Cuts I Wood Works, Types of Joint, Defects of Timber, Natural Defects and Artificial Defects, Seasoning, Preservation, Substitute of Timber, Commercial Forms of Timber, Characteristics of Good Timber, Use of Fastening, Shop Practice, Practical Job, Planning and Estimating of a given Job. Machine: Kinds of tools, Common bench and hand tools, Marking and layout tools, measuring tools, cutting tools, Bench work with job, Drilling, Sharper, Lathe and Milling Machines: Introduction, Type, size and capacity, uses and applications.

Teaching-learning and Assessment Strategy:
Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify how to work in workshop environments.						√						
Organize practical work in the engineering workshop in various environments.							√					
Demonstrate practical knowledge to produce engineering works like- foundry, carpentry, welding etc.									√			

Lecture Schedule:

Week	Lecture	Topics
1+ 2	Lab 1+ 2	Foundry: Introduction to foundry, tools and equipment; Patterns: function, pattern making, Molding: molding materials sand preparation, types of mold, procedure; Cores: types, core making materials; Metal melting and casting; Inspection of casting and casting defects
3+ 4	Lab 3+ 4	Welding: Metal joints, riveting, grooving, soldering, welding; Welding practice: electric arc steel, aluminum; Types of electrode; Welding defects: visual, destructive and non-destructive tests of welding. Gas welding and equipment; Types of flame; Welding of different types of material; Gas welding defects; Test of gas welding
5+ 6	Lab 5+ 6	Carpentry: Wood working tools, Wood working machine, Band Saw, Scroll Saw, Circular Saw, Jointer, Thickness Planner, Disc Sander, Wood Lathe, Types of Sawing, Common Cuts I Wood Works, Types of Joint, Defects of Timber, Natural Defects and Artificial Defects
7+ 8	Lab 7+ 8	Seasoning, Preservation, Substitute of Timber, Commercial Forms of Timber, Characteristics of Good Timber, Use of Fastening, Shop Practice, Practical Job, Planning and Estimating of a given Job
9+ 10	Lab 9+ 10	Machine: Kinds of tools, Common bench and hand tools, Marking and layout tools, measuring tools, cutting tools, Bench work with job, Drilling, Sharper, Lathe and Milling Machines: Introduction, Type, size and capacity, uses and applications
11+ 12	Lab 11+ 12	**Lab Test**
13	Lab 13	**Quiz**
14	Lab 14	**Viva**

Text and Ref Books:

1. Building Materials- Gurcharan Singh, Standard Publishes-Distributors-Del (2008).
2. Engineering Materials- M. A. Aziz.
3. Machine Shop Practice- James Anderson, W. A. Chapman.
4. Shop Theory (6^{th} ed)- Anderson and Tatro, McGraw-Hill Education (1976).

LEVEL-1 TERM-II

CSE-101 3 hours in a week, 3.00 Cr.

Discrete Mathematics

Pre-requisite: None

Rationale:

To introduce the basic elements of discrete mathematics which provide a foundation for an understanding of algorithms and data structures used in computing.

Objective:

1. To understand a wide range of discrete and combinatorial methods.
2. To demonstrate proficiency at an introductory level in a wide range of discrete techniques.
3. To demonstrate understanding and proficiency in basic algorithmic techniques.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Recognize and use division into cases in a proof.
4. Explain counter examples.

Course Content :

Mathematical Logic: propositional calculus and predicate calculus; Set theory: sets, relations, partially ordered sets, functions; Mathematical reasoning and proof techniques; Counting: permutations, combinations, principles of inclusion and exclusion; Discrete Probability; Recurrence relations and recursive algorithms; Growth of functions; Graph theory: graphs, paths, trees, cycles; Algebraic structures: rings and groups: Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Subgroups, Cyclic Group.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Use mathematically correct terminology and notation.	√											
Construct correct direct and indirect proofs.			√									
Recognize and use division into cases in a proof.		√										
Explain counter examples.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	The Foundations: Logic, Propositional Equivalence	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	The Foundations: Predicates and Quantifiers, Nested Quantifiers	
3	Lec 7 Lec 8 Lec 9	The Foundations: Methods of Proofs	
4	Lec 10 Lec 11 Lec 12	The Foundations: Sets, Set Operations, Functions	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	The Fundamentals: Algorithms, Integers and Division	
6	Lec 16 Lec 17 Lec 18	The Fundamentals: Integers and Algorithms	
7	Lec 19 Lec 20 Lec 21	Mathematical Reasoning, Induction and Recursion: Mathematical Induction	
8	Lec 22 Lec 23 Lec 24	Mathematical Reasoning, Induction and Recursion: Recursive Definitions and Structural Induction	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Counting Methods: Pigeonhole Principle and applications	

10	Lec 31 Lec 32 Lec 33	Advance Counting Techniques: Recurrence Relations	
11	Lec 28 Lec 29 Lec 30	Relations: Properties of Relations; Representing Relations	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Relations: Equivalence Relations	
13	Lec 37 Lec 38 Lec 39	Graphs and Trees: Introduction to Graphs and Trees	
14	Lec 40 Lec 41 Lec 42	Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates	

Text and Ref Books:

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

CSE-105 3 hours in a week, 3.00 Cr.

Structured Programming Language

Pre-requisite: CSE-100

Rationale:

To introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to program design and development.

Objective:

1. To provide basic concepts of compilers, interpreters and IDE
2. To know about various syntax, semantics of structured programming languages.
3. To analyze and design various applications using different library functions of structured programming language.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe algorithm and solve problems using computers.
2. Analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.
3. Develop basic programming skills with respect to program design and development.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe algorithm and solve problems using computers.	√											
Analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.		√										
Develop basic programming skills with respect to program design and development.			√									

Lecture Schedule

Week	Lecture	Topics	Clas Test
1	Lec 1 Lec 2 Lec 3	Programming Concepts, Program development Stages, Structured programming language	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Number System: binary, octal, decimal and hexadecimal systems; Data types and their memory allocation	
3	Lec 7 Lec 8 Lec 9	Operators, expressions, Basic Input/output; Control Structure: “if else”, “switch”, Flow Charts	
4	Lec 10 Lec 11 Lec 12	Control structures: loop	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Control structures: Nested loop	
6	Lec 16 Lec 17 Lec 18	Function, parameter passing convention; Recursion	
7	Lec 19 Lec 20 Lec 21	Advanced recursion; Variable length argument list, Command line parameters	
8	Lec 22 Lec 23 Lec 24	Pointers and arrays, Strings	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Multidimensional array, Dynamic memory allocation	
10	Lec 31 Lec 32 Lec 33	File I/O; Header files, Preprocessor. User defined data types: structures, unions, enumerations	
11	Lec 28 Lec 29 Lec 30	Error Handling; Bitwise Operations	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Linking, Library Functions	
13	Lec 37 Lec 38 Lec 39	Graphics	
14	Lec 40 Lec 41 Lec 42	Basic Data Structures: Stack, Queue and Review	

Text and Ref Books:

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

CSE-106 3 hours in a week, 1.50 Cr.

Structured Programming Language Sessional

Pre-requisite: None

Rationale:

To introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to program design and development.

Objective:

1. To learn basic idea of programming languages.
2. To learn how to program with C.
3. To learn how to think about the problems, their solutions and translating it to programming language.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss algorithm and solve problems using computers.
2. Practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.
3. Apply practical knowledge to develop basic programming skills with respect to program design and development.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss algorithm and solve problems using computers.									√			
Practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.						√						
Apply practical knowledge to develop basic programming skills with respect to program design and development.						√						

Lecture Plan:

Week	**Lab**	**Topics**
1	Lab 1	Mathematical problems using printf, scanf
2	Lab 2	Number System, memory allocation
3	Lab 3	Control Structure: “if else”, “else if”, “switch”
4	Lab 4	Control Structure: Problem on Loop- For, Do While
5	Lab 5	Problem on Nested Loop
6	Lab 6	Function, parameter passing convention
7	Lab 7	**Online-1**
8	Lab 8	Problem on Recursion
9	Lab 9	Problem on Pointer, Array, String
10	Lab 10	Problem on Multidimensional Array, Dynamic Memory Allocation
11	Lab 11	Problem on File IO, Problem on Structure, Union
12	Lab 12	Problem on Bitwise Operation

13	Lab 13	**Online-2**
14	Lab 14	**Quiz/Viva + Project**

Text and Ref Books:

1. Teach Yourself C - Herbert Schidlt
2. Programming in Ansi C - E Balagurusamy
3. C: The Complete Reference - Herbert Schildt
4. C Programming Language – Dennis M. Ritche
5. Sober Jonno Computer Programming Language C- Md Kamruzzaman Niton

EECE-169 3 hours in a week, 3.00 Cr.

Electronic Devices and Circuits

Pre-requisite: EECE-163

Rationale:

This subject is classified under the Applied Technology group and intended to teach the students the concepts, principles and working of basic electronic circuits. It is targeted to provide a basic foundation for technology areas like electronics devices, communication systems, industrial electronics as well as instrumentation, control systems and various electronic circuit design.

Objective:

1. To understand the basics of electronic devices like diode, Transistor, MOSFET etc and its applications.
2. To become skilled at designing different electronic circuits like rectifier, amplifiers etc. using electronic devices.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify the basic electronic devices such as diode, BJT, MOSFET, FET and also special electronic devices like operational amplifiers.
2. Analyse the characteristics and solving methods of the electronic devices.
3. Demonstrate the concepts of feedback circuits, their modelling and uses.

Course Content:

Introduction to semiconductors, p-n junction diode, I–V characteristics; Diode applications: half and full wave rectifiers, clipping and clamping circuits, regulated power supply; Bipolar Junction Transistor (BJT): principle of operation, Transistor circuit configurations (CE, CB, CC), BJT biasing, BJT Transistor modeling, small-signal analysis of single and multi- stage amplifiers, frequency response of BJT amplifier.

Field Effect Transistors (FET): Principle of operation of JFET and MOSFET, Depletion and enhancement type MOSFETs, Switching circuits using FETs, CMOS, biasing of FETs, FET small signal analysis, Low and high frequency response of FETs; Operational amplifiers (Op Amps) and its applications; Feedback and oscillators circuits; Introduction to IC fabrication processes.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify the basic electronic devices such as diode, BJT, MOSFET, FET and also special electronic devices like operational amplifiers.	√											
Analyse the characteristics and solving methods of the electronic devices.		√										
Demonstrate the concepts of feedback circuits, their modelling and uses.			√									

Lecture Schedule

Week	**Lecture**	**Topics**	**Class Test**
1	Lec 1 Lec 2 Lec 3	Introduction to semiconductors, p-n junction diode, I–V characteristics	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Diode applications: half and full wave rectifiers, clipping and clamping circuits, regulated power supply	
3	Lec 7 Lec 8 Lec 9	Bipolar Junction Transistor (BJT): principle of operation	

4	Lec 10 Lec 11 Lec 12	Transistor circuit configurations (CE, CB, CC), BJT biasing	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	BJT Transistor modeling, small-signal analysis of single and multi- stage amplifiers, frequency response of BJT amplifier.	
6	Lec 16 Lec 17 Lec 18	Field Effect Transistors (FET): Principle of operation of JFET and MOSFET	
7	Lec 19 Lec 20 Lec 21	Depletion and enhancement type MOSFETs	
8	Lec 22 Lec 23 Lec 24	Switching circuits using FETs	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	CMOS, biasing of FETs, FET small signal analysis	
10	Lec 31 Lec 32 Lec 33	Low and high frequency response of FETs	
11	Lec 28 Lec 29 Lec 30	Operational amplifiers (Op Amps) and its applications	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Feedback and oscillators circuits	
13	Lec 37 Lec 38 Lec 39	Introduction to IC fabrication processes	
14	Lec 40 Lec 41 Lec 42	IC fabrication processes module	

Text and Ref Books:

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

EECE-170 3 hours in a week, 1.50 Cr.

Electronic Devices and Circuits Sessional

Pre-requisite: None

Rationale:

To learn and familiarize with the basics of electronic circuits as well as utilizing electronic devices for practical purposes.

Objective:

1. To learn about electronic circuits.
2. To know and use the electronic circuits and devices for theoretical and practical purposes.
3. To learn about operational amplifier circuits.
4. To solve complex design problems regarding electronics based on realistic aspects.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Practically understand the basic electronic devices such as diode, BJT, MOSFET, FET and also special electronic devices like operational amplifiers.
2. Apply practical knowledge to analyse the characteristics and solving methods of the electronic devices.
3. Demonstrate the concepts of feedback circuits, their modelling and uses.

Course Content :

Study of Diode Characteristics, Study of Diode Rectifier, Study of N-P-N CB (Common Base) Transistor Characteristics, Study of N-P-N CE (Common Emitter) Transistor Characteristics, Study of BJT Biasing Circuits, Study the Characteristics of JFET, Mathematical Operations Using Op-Amp, SCR Operation Characteristic in DC Circuit.

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Practically understand the basic electronic devices such as diode, BJT, MOSFET, FET and also special electronic devices like operational amplifiers.						√						
Apply practical knowledge to analyse the characteristics and solving methods of the electronic devices.							√					
Demonstrate the concepts of feedback circuits, their modelling and uses.							√					

Lecture Plan:

Week	Lab	Topics
1	Lab 1	Study of Diode Characteristics
2	Lab 2	Study of Diode Rectifier
3	Lab 3	Study of N-P-N CB (Common Base) Transistor Characteristics
4	Lab 4	Study of N-P-N CE (Common Emitter) Transistor Characteristics
5	Lab 5	Study of BJT Biasing Circuits
6	Lab 6	**Lab Test- 01**
7	Lab 7	Study the Characteristics of JFET
8+ 9	Lab 8+ 9	Mathematical Operations Using Op-Amp

10	Lab 10	SCR Operation Characteristic in DC Circuit
11	Lab 11	**Lab Test- 02**
12	Lab 12	**Quiz**
13+ 14	Lab 13+ 14	**Viva**

Text and Ref Books:

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

3 hours in a week, 1.50 Cr.

CE-150

Engineering Drawing & CAD Sessional

Pre-requisite: None

Rationale:

To provide the idea of basic electronic devices and amplifiers, analyse the concepts of circuits, their modeling and uses.

Objective:

1. Understand the Engineering drawing which helps to communicates ideas and information.
2. Communicate all needed information from the engineer to workers or manufacturer who constructs any kind of structural element.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Explain the Engineering drawing which helps to communicate ideas and information.
2. Communicate all needed information from the engineer to workers or manufacturer who constructs any kind of structural element.
3. Design solutions for complex structural engineering problems for different environmental context.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain the Engineering drawing which helps to communicate ideas and information.										√		
Communicate all needed information from the engineer to workers or manufacturer who constructs any kind of structural element.									√			
Design solutions for complex structural engineering problems for different environmental context.						√						

Lecture Plan:

Week	Lab	Topics
1	Lab 1	Engineering Drawing & CAD Sessional Introduction
2	Lab 2	Lettering, numbering and heading
3	Lab 3	Instrument and their use
4	Lab 4	Sectional views of solid geometrical figure
5	Lab 5	Isometric views of solid geometrical figure
6	Lab 6	Plan, Elevation and Section of one-story building
7	Lab 7	**Lab Test- 01**
8	Lab 8	Building service drawing (Electrical layout and Plumbing)
9	Lab 9	Detailed drawing of lattice towers
10	Lab 10	Use of AutoCAD software
11	Lab 11	**Lab Test- 02**
12	Lab 12	**Quiz**
13+ 14	Lab 13+ 14	**Viva**

Text and Ref Books:

1. Prathomik Engineering Drawing - Hemanta Kumar Bhattacharyya

3 hours in a week, 3.00 Cr.

CHEM-101

Chemistry

Pre-requisite: None

Rationale:

To provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.

Objective:

1. To learn laboratory skills to design, conduct and interpret chemical research.
2. To expose the students to a breadth of experimental techniques using modern instrumentation.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify the basic knowledge of different areas of chemistry.
2. Interpret the application of computer science in chemistry.
3. Apply the knowledge of chemistry for studying wide range of subjects such as medical science.

Course Content:

Atomic structure, quantum numbers, electronic configuration, periodic table; Properties and uses of noble gases; Different types of chemical bonds and their properties; chemical bonding and concepts of conductor, insulator, semi-conductor; Molecular structure of compounds: Selective organic reactions; introduction to computational chemistry, Different types of solutions and their compositions; Phase rule. Phase diagram of mono component system; Properties of dilute solution; Thermo chemistry, chemical kinetics, chemical equilibrium; Electrical properties of Solution. pH and buffer solutions, Eletro-chemical cell reactions.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify the basic knowledge of different areas of chemistry.	√											
Interpret the application of computer science in chemistry.		√										
Apply the knowledge of chemistry for studying wide range of subjects such as medical science.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Atomic structure, quantum numbers	
2	Lec 4	Electronic configuration, periodic table	

	Lec 5 Lec 6		**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Properties and uses of noble gases	
4	Lec 10 Lec 11 Lec 12	Different types of chemical bonds and their properties	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Chemical bonding and concepts of conductor, insulator, semi-conductor	
6	Lec 16 Lec 17 Lec 18	Molecular structure of compounds: Selective organic reactions	
7	Lec 19 Lec 20 Lec 21	Introduction to computational chemistry	
8	Lec 22 Lec 23 Lec 24	Different types of solutions and their compositions	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Phase rule. Phase diagram of mono component system	
10	Lec 31 Lec 32 Lec 33	Properties of dilute solution	
11	Lec 28 Lec 29 Lec 30	Thermo chemistry	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Chemical kinetics, chemical equilibrium	
13	Lec 37 Lec 38 Lec 39	Electrical properties of Solution	
14	Lec 40 Lec 41 Lec 42	pH and buffer solutions, Eletro-chemical cell reactions.	

Text and Ref Books:

1. Principles of Physical Chemistry – Haque & Nawab
2. Physical Chemistry - P. W. Atkins; Oxford University Press.

3 hours in a week, 3.00 Cr.

MATH-143

Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)

Pre-requisite: None

Rationale:

To provide knowledge of formation, classification, order and application of Ordinary Differential Equation, Partially Differential Equation and also give skill of problem solving regarding geometry.

Objective:

1. To provide the basic idea of formation of Ordinary Differential Equation and find out the solution and use in various application.
2. To provide the basic idea of formation of Partial Differential Equation and find out the solution and use in various application
3. To demonstrate the various aspects of geometry.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify the formation, solution and application of Ordinary Differential Equation.
2. Express the formation, solution and application of Partial Differential Equation.
3. Solve the problems related to the pair of straight lines, circles, system of circles, parabola, ellipse etc.

Course Content:

Ordinary Differential Equations: Introduction to Differential Equations, Formulation of Differential Equations; Solution of first order differential equations by various methods, Solution of differential equation of first order but higher degrees; Solution of general linear equations of second and higher orders with constant co-efficient, Solution of Euler's Homogeneous linear differential equations, Application of ODE.

Partial Differential Equations: Introduction, Linear and nonlinear first order differential equations; Standard forms; linear equations of higher order; Equation of second order with variable coefficients, Application of PDE.

Coordinate Geometry: Introduction to geometry, transformation of coordinates, pair of straight lines; general equation of second degree and reduction to its standard forms and find the properties; circles (tangents, normal, chord of contact, pole and polar); system of circles (radical axes, coaxial circles, limiting points); equation of conies, parabola, ellipse (conjugate diameters) and hyperbola.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify the formation, solution and application of Ordinary Differential Equation.		√										
Express the formation, solution and application of Partial Differential Equation.			√									
Solve the problems related to the pair of straight lines, circles, system of circles, parabola, ellipse etc.			√									

Lecture Schedule

Week	**Lecture**	**Topics**	**Class Test**
1	Lec 1 Lec 2 Lec 3	Ordinary Differential Equations: Introduction to Differential Equations, Formulation of Differential Equations	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Solution of first order differential equations by various methods	
3	Lec 7 Lec 8 Lec 9	Solution of general linear equations of second and higher orders with constant co-efficient	
4	Lec 10 Lec 11 Lec 12	Solution of Euler's Homogeneous linear differential equations	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Partial Differential Equations: Introduction, Linear and nonlinear first order differential equations	

6	Lec 16 Lec 17 Lec 18	Standard forms; linear equations of higher order	
7	Lec 19 Lec 20 Lec 21	Equation of second order with variable coefficients, Application of PDE	
8	Lec 22 Lec 23 Lec 24	Coordinate Geometry: Introduction to geometry, transformation of coordinates, pair of straight lines	
9	Lec 25 Lec 26 Lec 27	General equation of second degree and reduction to its standard forms and find the properties	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Circles (tangents, normal, chord of contact, pole and polar)	
11	Lec 28 Lec 29 Lec 30	System of circles (radical axes, coaxial circles, limiting points)	
12	Lec 34 Lec 35 Lec 36	Equation of conies, parabola, ellipse (conjugate diameters) and hyperbola	
13	Lec 37 Lec 38 Lec 39	Application of ODE	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Solution of differential equation of first order but higher degrees	

Text and Ref Books:

1. Ordinary and Partial Differential Equations - Raisinghania.
2. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee.

LEVEL-2 TERM-I

CSE-201 — 3 hours in a week, 3.00 Cr.

Digital Logic Design

Pre-requisite: None

Rationale:
To design circuits and logic gates, gather knowledge about different types of computer chips and learn to represent signals and sequences of a digital circuit through numbers.

Objective:
1. To understand the different switching algebra theorems and apply them for solving logic functions.
2. To understand Karnaugh map and other methods to perform an algorithmic reduction of multivariable logic functions.
3. To understand combinational circuits: adder, subtractor, encoders/decoders, multiplexers, de-multiplexers, arithmetic-logic units.
4. To analyze the bi-stable element, different latches and flip-flops.
5. To understand and analyze sequential circuits, like counters and shift registers.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Design with combinational and sequential digital logic and state machines.
2. To solve different switching algebra problems of logic functions.
3. Identify, explain and diagnose the Karnaugh map for multi variable and perform an algorithmic reduction of logic functions.
4. Identify, recognize and diagnose the combinational circuits: adder, subtractor, encoders/decoders, multiplexers, de-multiplexers, arithmetic-logic units.
5. Design of digital circuits and systems.

Course Content:
Number systems, complements and codes; Digital logic: Boolean algebra, De-Morgan`s theorems, logic gates and their truth tables, canonical forms, combinational logic circuits, minimization techniques; Arithmetic and data handling logic circuits, decoders and

encoders, multiplexers and de-multiplexers; Flip-flops, race around problems; Counters; asynchronous counters, synchronous counters and their applications; Registers and basic memory unit; Synchronous and asynchronous logic design; Design of sequential circuit: State diagram; Mealy and Moor machines; State minimizations and assignments; Pulse mode logic; Fundamental mode design; PLA design using MSI and LSI components.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Design with combinational and sequential digital logic and state machines.	√											
To solve different switching algebra problems of logic functions.		√										
Identify, explain and diagnose the Karnaugh map for multi variable and perform an algorithmic reduction of logic functions.				√								
Identify, recognize and diagnose the combinational circuits: adder, subtractor, encoders/decoders, multiplexers, de-multiplexers, arithmetic-logic units.					√							
Design of digital circuits and systems	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Number systems, complements and codes	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Digital logic: Boolean algebra, De-Morgan`s theorems	
3	Lec 7 Lec 8 Lec 9	Logic gates and their truth tables, canonical forms	
4	Lec 10 Lec 11 Lec 12	Combinational logic circuits, minimization techniques	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Arithmetic and data handling logic circuits	
6	Lec 16 Lec 17	Decoders and encoders, multiplexers and de-multiplexers	

	Lec 18		
7	Lec 19 Lec 20 Lec 21	Flip-flops, race around problems	
8	Lec 22 Lec 23 Lec 24	Counters; asynchronous counters, synchronous counters and their applications	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Registers and basic memory unit	
10	Lec 31 Lec 32 Lec 33	Synchronous and asynchronous logic design	
11	Lec 28 Lec 29 Lec 30	Design of sequential circuit: State diagram	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Mealy and Moor machines; State minimizations and assignments	
13	Lec 37 Lec 38 Lec 39	Pulse mode logic; Fundamental mode design	
14	Lec 40 Lec 41 Lec 42	PLA design using MSI and LSI components	

Text and Ref Books:

1. Digital Logic and Computer Design (4th ed) - M. Morris Manno (2007)
2. Digital Computer Electronics (3th ed) - Albert P. Malvino, Jerald A Brown (2001)

CSE-202 3 hours in a week, 1.50 Cr.

Digital Logic Design Sessional

Pre-requisite: None

Rationale:
This course aims to provide students with a knowledge of problem solving with digital logic circuits & systems. The basic building blocks of combinational and sequential circuits are introduced to enable students to develop circuit solutions to problems and to understand the design and operation of hardware models of digital systems

Objective:

1. To gain basic knowledge on logic design and the basic building blocks used in digital systems, in particular digital computers.
2. To design combinational logic circuit and their implementations.
3. To design sequential logic circuit and their implementations.
4. To design and implement of digital circuits and systems.
5. To derive the state-machine analysis or synthesis and to perform simple projects with a few flip-flops.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Demonstrate the basic tools for designing with combinational and sequential digital logic and state machines.
2. Interpret practical knowledge to state simple digital circuits in preparation for computer engineering.
3. Describe the different switching algebra theorems and apply them for logic functions.
4. Practically correlate a given problem, design with different ICs and equipment.
5. Practically predict or syntheses simple projects and design those projects with different equipment.

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate the basic tools for designing with combinational and sequential digital logic and state machines.									√			
Interpret practical knowledge to state simple digital circuits in preparation for computer engineering.									√			
Describe the different switching algebra theorems and apply them for logic functions.							√					
Practically correlate a given problem, design with different ICs and equipment.						√						
Practically predict or syntheses simple projects and design those projects with different equipment.									√			

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Verify Basic Logic Gates and Truth Tables of the Logic Gates	
2	Lec 4 Lec 5 Lec 6	Combinational Circuit (Light Your Lamp)	
3	Lec 7 Lec 8 Lec 9	Experiments Based on Truth tables and Boolean functions	
4	Lec 10 Lec 11 Lec 12	Experiments Based on Truth tables and K-maps	
5	Lec 13 Lec 14 Lec 15	Design and implementation of the Logic Circuits using K-maps (7 Segment Display)	
6	Lec 16 Lec 17 Lec 18	Experiments Based on Adder/Subtractor	
7	Lec 19 Lec 20 Lec 21	Lab Test 1	
8	Lec 22 Lec 23 Lec 24	Experiments Based on Comparator	
9	Lec 25 Lec 26 Lec 27	Design and implementation of Combinational circuit using Multiplexer	
10	Lec 31 Lec 32	Design and Implementation of encoder and decoder	

	Lec 33		
11	Lec 28 Lec 29 Lec 30	Design and implement Flip Flop using basic gates	
12	Lec 34 Lec 35 Lec 36	Design and implement counters using Flip-Flops	
13	Lec 37 Lec 38 Lec 39	Lab Test 2	
14	Lec 40 Lec 41 Lec 42	Quiz & Viva	

Text and Ref Books:

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

CSE-203 3 hours in a week, 3.00 Cr.

Data Structures and Algorithms-I

Pre-requisite: CSE-105

Rationale:
The study of data structure is an essential part of computer science. Data structure is a logical & mathematical model of storing & organizing data in a particular way in a computer. In system programming application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logic & structured programs.

Objective:

1. General Understanding of Basic Data Structures
2. Developing Programming Skills for Advanced Data Structures such as Trees, Hash Tables, Priority Queues etc

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Express the fundamentals of static and dynamic data structures and relevant standard algorithms.
2. Demonstrate advantages and disadvantages of specific algorithms and data structures.
3. Select basic data structures and algorithms for autonomous realization of simple programs or program parts.
4. Determine and demonstrate bugs in program, recognize needed basic operations with algorithms and data structures.

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Express the fundamentals of static and dynamic data structures and relevant standard algorithms.	√											
Demonstrate advantages and disadvantages of specific algorithms and data structures.	√											
Select basic data structures and algorithms for autonomous realization of simple programs or program parts.		√										
Determine and demonstrate bugs in program, recognize needed basic operations with algorithms and data structures.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Array	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Array search and Sorting	
3	Lec 7 Lec 8 Lec 9	Asymtopic notation	
4	Lec 10 Lec 11 Lec 12	Linked list	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Stack - Queue	
6	Lec 16 Lec 17 Lec 18	Trees	
7	Lec 19 Lec 20 Lec 21	Heap-Priority Queue	
8	Lec 22 Lec 23 Lec 24	Graph-01	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Graph-02	
10	Lec 31 Lec 32 Lec 33	Merge-sort+Quick-sort	
11	Lec 28 Lec 29 Lec 30	Merge-sort+Quick-sort	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Binary Search Tree	
13	Lec 37 Lec 38 Lec 39	Binary Search Tree	
14	Lec 40 Lec 41 Lec 42	Skip List	

Text and Ref Books:

1. Classic Data Structures 2nd Ed – Debasis Samanta
2. Data Structures using C 2nd Ed – Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein

CSE-204 **3 hours in a week, 1.50 Cr.**

Data Structures and Algorithms-I Sessional

Pre-requisite: None

Rationale:
The study of data structure is an essential part of computer science. Data structure is a logical & mathematical model of storing & organizing data in a particular way in a computer. In system programming application programming the methods & techniques of data structures are widely used. The study of data structure helps the students in developing logic & structured programs.

Objective:

1. General Understanding of Basic Data Structures
2. Developing Programming Skills for Advanced Data Structures such as Trees, Hash Tables, Priority Queues etc

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Practically demonstrate advantages and disadvantages of specific algorithms and data structures.
2. Select basic data structures and algorithms for autonomous realization of simple programs or program parts.
3. Initiate practical knowledge to determine and demonstrate bugs in programs.
4. Formulate new solutions for problems or improve existing code using learned algorithms and data structures.

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Practically demonstrate advantages and disadvantages of specific algorithms and data structures.									√			
Select basic data structures and algorithms for autonomous realization of simple programs or program parts.									√			
Initiate practical knowledge to determine and demonstrate bugs in programs.									√			
Formulate new solutions for problems or improve existing code using learned algorithms and data structures.						√						

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1	Lec 1 Lec 2 Lec 3	Array List (Implementing List using Array)	
2	Lec 4 Lec 5 Lec 6	Binary Search	
3	Lec 7 Lec 8 Lec 9	Implementing Stack using Array	
4	Lec 10 Lec 11 Lec 12	Implementation of Queue using Array, Circular Queue	
5	Lec 13 Lec 14 Lec 15	Single Linked List Implementation	
6	Lec 16 Lec 17 Lec 18	Practice on Single Linked List	

7	Lec 19 Lec 20 Lec 21	**Online -1**	
8	Lec 22 Lec 23 Lec 24	Double Linked List Implementation	
9	Lec 25 Lec 26 Lec 27	Operation on Binary Search Tree (Insertion, Deletion, Traversal, Merging)	
10	Lec 31 Lec 32 Lec 33	Operation on Heap Trees/Priority Queue (MAX and MIN Heap)	
11	Lec 28 Lec 29 Lec 30	Implementation of Graph Algorithms: BFS	
12	Lec 34 Lec 35 Lec 36	Implementation of Graph Algorithms: DFS	
13	Lec 37 Lec 38 Lec 39	**Online-02**	
14	Lec 40 Lec 41 Lec 42	**Quiz**	

Text and Ref Books:

1. Classic Data Structures 2nd Ed – Debasis Samanta
2. Data Structures using C 2nd Ed – Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein

CSE-205 3 hours in a week, 3.00 Cr.

Object Oriented Programming Language

Pre-requisite: CSE-105

Rationale:
Object-oriented programming is a programming paradigm that includes or relies on the concept of objects, encapsulated data structures that have properties and functions and which interact with other objects

Objective:

1. To achieve a basic idea on Object Oriented Programming Language
2. Present object-oriented aspects of C++
3. To learn programming with C++

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Grasp and utilize the fundamental features of an object oriented language like C++ / Java.
2. Explain the benefits of object oriented design and understand when it is an appropriate methodology to use.
3. Deduce object oriented solutions for small problems, involving multiple objects.
4. Illustrate good programming style and identify the impact of style on developing and maintaining programs.

Course Content:

Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, Destructors and Copy Constructors; Array of objects, object pointers, and object references; In-line functions, friend functions, static functions; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exception Handling; Object Oriented I/O ; Template functions and classes; Concept of Namespaces, Overview of Standard Template Library (Vectors & Iterators); Multi-threaded Programming, Abstract Data Types.

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Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Grasp and utilize the fundamental features of an object oriented language like C++ / Java.	√											
Explain the benefits of object oriented design and understand when it is an appropriate methodology to use.				√								
Deduce object oriented solutions for small problems, involving multiple objects.			√		√							
Illustrate good programming style and identify the impact of style on developing and maintaining programs.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Overview of Object Oriented Programming(OOP) and introduction to C++; Features of OOP, namespaces	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Introduction to class and objects, Access Specifiers	
3	Lec 7 Lec 8 Lec 9	Member Functions, In-line functions, Friend functions, Function Overloading	
4	Lec 10 Lec 11 Lec 12	Introduction to the concept of Constructors and Destructors	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Copy Constructors	
6	Lec 16 Lec 17 Lec 18	Using arrays of objects and references of objects, Using objects as arguments and returning objects from functions	
7	Lec 19 Lec 20 Lec 21	Inheritance: Introduction, derived and base classes, accessing base class members, access specified for ‘protected’	
8	Lec 22 Lec 23 Lec 24	Multiple inheritance, Constructor and destructor in Inheritance	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Virtual functions, runtime polymorphism and overriding Abstract class	
10	Lec 31 Lec 32 Lec 33	Operator overloading: Introduction, overloading of unary operators	
11	Lec 28 Lec 29 Lec 30	Operator overloading: Overloading of binary operators, multiple overloading	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Operator overloading: Comparison operators, data conversion and review of operator overloading	
13	Lec 37 Lec 38 Lec 39	Generic function, Generic class, Exception handling	
14	Lec 40 Lec 41 Lec 42	Library	

Text and Ref Books:

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

CSE-206 3 hours in a week, 1.50 Cr.

Object Oriented Programming Language Sessional-I

Pre-requisite: None
Rationale:

Object-oriented programming is a programming paradigm that includes or relies on the concept of objects, encapsulated data structures that have properties and functions and which interact with other objects

Objective:

1. To achieve a basic idea on Object Oriented Programming Language
2. Present object-oriented aspects of C++
3. To learn programming with C++

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Practice object oriented Programming and design object oriented solutions for small systems/ problems, involving multiple objects.
2. Demonstrate good programming style and discuss the impact of style on developing and maintaining programs.
3. Identify the relative merits of different algorithmic designs, programming constructs and data structures.
4. Able to write code, test, document and prepare a professional looking package for specified systems / problems.

Course Content:

Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, Destructors and Copy Constructors; Array of objects, object pointers, and object references; In-line functions, friend functions, static functions; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exception Handling; Object Oriented I/O ; Template functions and classes; Concept of Namespaces, Overview of Standard Template Library (Vectors & Iterators); Multi-threaded Programming, Abstract Data Types

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Practice object oriented Programming and design object oriented solutions for small systems/ problems, involving multiple objects.									√			
Demonstrate good programming style and discuss the impact of style on developing and maintaining programs.								√				
Identify the relative merits of different algorithmic designs, programming constructs and data structures.									√			
Able to write code, test, document and prepare a professional looking package for specified systems / problems.											√	

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Introductory session on OOP	
2	Lec 4 Lec 5 Lec 6	Structure and Classes with namespace	
3	Lec 7 Lec 8 Lec 9	Class and objects with access specifier	
4	Lec 10 Lec 11 Lec 12	Member Functions, In-line functions, Friend functions, Function Overloading	
5	Lec 13 Lec 14 Lec 15	Introduction to the concept of Constructors and Destructors	
6	Lec 16 Lec 17 Lec 18	Copy Constructors	
7	Lec 19 Lec 20 Lec 21	Online -1	
8	Lec 22 Lec 23 Lec 24	Inheritance: Introduction, derived and base classes, accessing base class members, access specified for 'protected'	
9	Lec 25 Lec 26 Lec 27	Multiple inheritance, Constructor and destructor in Inheritance	
10	Lec 31 Lec 32 Lec 33	Virtual functions, runtime polymorphism and overriding Abstract class	
11	Lec 28 Lec 29 Lec 30	Operator overloading: Introduction, overloading of unary operators	
12	Lec 34 Lec 35 Lec 36	Operator overloading: Overloading of binary operators, multiple overloading	
13	Lec 37 Lec 38 Lec 39	Online-2	
14	Lec 40 Lec 41 Lec 42	Quiz and Viva	

Text and Ref Books:

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

EECE-269 3 hours in a week, 3.00 Cr.

Electrical Drives and Instrumentation

Pre-requisite: EECE-169

Rationale:
The course enables students to acquire knowledge and skills on electrical instrumentation and measurements.

Objective:

1. To understand electrical principle, laws, and working of DC machines.
2. To analyze the construction and characteristics and application of various type of DC generators.
3. To analyze the construction and characteristics and application of various type of DC motors and testing of motors according to Indian standard.
4. To understand electrical principle, laws, and working of 1 phase transformer and losses. And also conduct various test on the transformer.
5. To understand electrical principle, laws, and working of 3 phase transformer and losses. And also conduct various test on the transformer.
6. To analyze the transformer and convert 3 phase transformer to multi phase transformer

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand the construction, working principle, losses and other important characteristics of transformers, dc generators and motors etc.
2. Understand the working principles and applications of instrumentation amplifiers, recording and display devices, spectrum and logic analyzers etc.

3. Identify the types, principles and applications of various transducers.
4. Analyze the various processes of noise reduction techniques in circuits

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Understand the construction, working principle, losses and other important characteristics of transformers, dc generators and motors etc.	√											
Understand the working principles and applications of instrumentation amplifiers					√							
Identify the types, principles and applications of various transducers.				√								
Analyze the various processes of noise reduction techniques in circuits	√											

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Transformer: Faraday's Law, Lenz's law, Introduction to Transformer, Construction, Types, Working Principle, E.M.F. Equation of a Transformer	
2	Lec 4 Lec 5 Lec 6	Ideal Transformers, Transformation Ratio Practical Transformer, Transformer on No-Load, Transformer on Load, Equivalent Circuit, Losses, Why Transformer Rating in kVA? Efficiency, All	

		day efficiency, Condition for maximum efficiency, Voltage Regulation	**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Parallel Operations, Condition for Parallel Operations, Problems.	
4	Lec 10 Lec 11 Lec 12	DC Generator: Construction, Generator Principle, E.M.F. Equation of a DC Generator,,	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Types, Losses, Power Stages, Efficiency, Condition for maximum efficiency, Voltage Regulation, Parallel operation of Shunt Generator, Characteristics, Armature Reaction, Compensating Windings, Problems.	
6	Lec 16 Lec 17 Lec 18	Alternators: Working Principle, Advantages of Stationary Armature, Speed & Frequency, Winding Factors, E.M.F. Equation of an Alternator , Armature Reaction, Voltage Regulation, Parallel Operation , Condition for Parallel Operation, Problems.	
7	Lec 19 Lec 20 Lec 21	Alternators: Working Principle, Advantages of Stationary Armature, Speed & Frequency, Winding Factors, E.M.F. Equation of an Alternator , Armature Reaction, Voltage Regulation, Parallel Operation , Condition for Parallel Operation, Problems.	
8	Lec 22 Lec 23 Lec 24	DC Motor: Construction, Working Principle, Comparison of Generator & Motor Action , Back or Counter E.M.F, Significance of Back or Counter E.M.F, Voltage Equation, Power Equation, Efficiency, Power Stages, Types, Armature Torque of a Motor, Shaft Torque of a Motor, Speed, Speed Regulation, Motor Characteristics, Problems.	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
10	Lec 31 Lec 32 Lec 33	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
11	Lec 28 Lec 29 Lec 30	Synchronous Motor: Construction, Principle of Operation, Making Synchronous Motor Self-Starting, Mechanical Power Developed by SM, Special Machine: Stepper Motor, Servo Motor.	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
13	Lec 37 Lec 38	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor	

	Lec 39	Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
14	Lec 40 Lec 41 Lec 42	Synchronous Motor: Construction, Principle of Operation, Making Synchronous Motor Self-Starting, Mechanical Power Developed by SM, Special Machine: Stepper Motor, Servo Motor.	

Text and Ref Books:

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

EECE-270 — 1.50 hours in a week, 0.75 Cr.

Electrical Drives and Instrumentation Sessional

Pre-requisite:

Rationale:

The course enables students to acquire knowledge and skills on electrical instrumentation and measurements.

Objective:

1. To understand electrical principle, laws, and working of DC machines.
2. To analyze the construction and characteristics and application of various type of DC generators.
3. To analyze the construction and characteristics and application of various type of DC motors and testing of motors according to Indian standard.
4. To understand electrical principle, laws, and working of 1 phase transformer and losses. And also conduct various test on the transformer.
5. To understand electrical principle, laws, and working of 3 phase transformer and losses. And also conduct various test on the transformer.
6. To analyze the transformer and convert 3 phase transformer to multi phase transformer

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand the construction, working principle, losses and other important characteristics of transformers, dc generators and motors etc.
2. Understand the working principles and applications of instrumentation amplifiers, recording and display devices, spectrum and logic analyzers etc.
3. Identify the types, principles and applications of various transducers.
4. Analyze the various processes of noise reduction techniques in circuits

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, lab tests, quiz, report.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Understand the construction, working principle, losses and other important characteristics of transformers, dc generators and motors etc.												√

Understand the working principles and applications of instrumentation amplifiers									√			
Identify the types, principles and applications of various transducers.						√						
Analyze the various processes of noise reduction techniques in circuits							√					

Lecture Schedule:

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Transformer: Faraday's Law, Lenz's law, Introduction to Transformer, Construction, Types, Working Principle, E.M.F. Equation of a Transformer	
2	Lec 4 Lec 5 Lec 6	Ideal Transformers, Transformation Ratio Practical Transformer, Transformer on No-Load, Transformer on Load, Equivalent Circuit, Losses, Why Transformer Rating in kVA? Efficiency, All day efficiency, Condition for maximum efficiency, Voltage Regulation	
3	Lec 7 Lec 8 Lec 9	Parallel Operations, Condition for Parallel Operations, Problems.	
4	Lec 10 Lec 11 Lec 12	DC Generator: Construction, Generator Principle, E.M.F. Equation of a DC Generator,,	
5	Lec 13 Lec 14 Lec 15	Types, Losses, Power Stages, Efficiency, Condition for maximum efficiency, Voltage Regulation, Parallel operation of Shunt Generator, Characteristics, Armature Reaction, Compensating Windings, Problems.	
6	Lec 16 Lec 17 Lec 18	Alternators: Working Principle, Advantages of Stationary Armature, Speed & Frequency, Winding Factors, E.M.F. Equation of an Alternator , Armature Reaction, Voltage Regulation, Parallel Operation , Condition for Parallel Operation, Problems.	
7	Lec 19 Lec 20 Lec 21	Alternators: Working Principle, Advantages of Stationary Armature, Speed & Frequency, Winding Factors, E.M.F. Equation of an Alternator , Armature Reaction, Voltage Regulation, Parallel Operation , Condition for Parallel Operation, Problems.DC Motor: Construction, Working Principle, Comparison of Generator & Motor Action , Back or Counter E.M.F, Significance of Back or Counter E.M.F, Voltage Equation, Power Equation, Efficiency, Power Stages,	

		Types, Armature Torque of a Motor, Shaft Torque of a Motor, Speed, Speed Regulation, Motor Characteristics, Problems.	
8	Lec 22 Lec 23 Lec 24	Lab Test -1	
9	Lec 25 Lec 26 Lec 27	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
10	Lec 31 Lec 32 Lec 33	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
11	Lec 28 Lec 29 Lec 30	Synchronous Motor: Construction, Principle of Operation, Making Synchronous Motor Self-Starting, Mechanical Power Developed by SM, Special Machine: Stepper Motor, Servo Motor.	
12	Lec 34 Lec 35 Lec 36	Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.Single-Phase Induction Motor: Principle of Operation, Speed of rotating magnetic field, Slip, Rotor Current Frequency, Rotor Torque, Motor Torque, Starting Torque, Condition for Maximum Starting Torque, Speed Regulation of Induction Motors, Making Single-Phase Induction Motor Self-Starting, Problems.	
13	Lec 37 Lec 38 Lec 39	Lab test 2	
14	Lec 40 Lec 41 Lec 42	Quiz/Viva	

Text and Ref Books:

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

MATH-245 **3 hours in a week, 3.00 Cr.**

Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)

Pre-requisite: None

Rationale:
In this course, students will look at basic properties of vectors, matrices as objects rather than just as a tool for solving systems of linear equations and Fourier analysis to solve different problems.

Objective:

1. To analyze the characteristics of scalar and vector valued functions and master these in calculations
2. To analyze physical interpretation of the gradient, divergence, curl and related concepts
3. To calculate differentiation and integration of vector valued functions in cartesian, cylindrical and spherical geometry
4. To understand transform vector valued functions between different coordinate system,

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand mathematics, science and engineering such as calculating volume and area of any object in vector field.
2. Carry out differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry and also able to construct relation between line, surface and volume integration.
3. Provide a physical interpretation of the gradient, divergence, curl and related concepts.
4. Explain the characteristics of scalar and vector valued functions and master these in calculations.

Course Content:

Vector Analysis: Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars; Scalar and vector product of two vectors and their geometrical interpretation: Triple products and multiple products; Linear dependence and independence of vectors. Differentiation and integration of vectors along with elementary applications; vector geometry; Definition of line, surface and volume integrals; Gradient, divergence and curl of point functions, Green's theorem, Gauss's theorem, Stoke's theorem and their applications.

Matrices: Definition of matrix; Algebra of matrices; transpose of a matrix, inverse of matrix; rank and elementary transformations of matrices; Solution of linear equations; linear dependence and independence of vectors. Quadratic forms, matrix polynomials, determination of characteristic root and vectors, null space and nullity of matrix, characteristic subspace of matrix, Cay-ley Hamilton theorem and its application.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Understand mathematics, science and engineering such as calculating volume and area of any object in vector field.	√											
Carry out differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry and also able to construct relation between line, surface and volume integration.					√							
Provide a physical interpretation of the gradient, divergence, curl and related concepts.	√											
Explain the characteristics of scalar and vector valued functions and master these in calculations.			√									

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Scalars and vectors, equality of vectors; Addition and subtraction of vectors; Multiplication of vectors by scalars;	
2	Lec 4 Lec 5 Lec 6	Scalar and vector product of two vectors and their geometrical interpretation: Triple products and multiple products	
3	Lec 7 Lec 8 Lec 9	Linear dependence and independence of vectors	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Differentiation and integration of vectors along with elementary applications;	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	vector geometry, Definition of line, surface and volume integrals; Gradient, divergence and curl of point functions	

6	Lec 16 Lec 17 Lec 18	Green's theorem, Gauss's theorem, Stoke's theorem and their applications.	
7	Lec 19 Lec 20 Lec 21	Definition of matrix; Algebra of matrices; transpose of a matrix, inverse of matrix; rank and elementary transformations of matrices;	
8	Lec 22 Lec 23 Lec 24	Solution of linear equations; linear dependence and independence of vectors. Quadratic forms, matrix polynomials, determination of characteristic root and vectors	
9	Lec 25 Lec 26 Lec 27	Matrix polynomials, determination of characteristic root and vectors	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Null space and nullity of matrix, characteristic subspace of matrix, Cay-ley Hamilton theorem and it's application.	
11	Lec 28 Lec 29 Lec 30	Cay-ley Hamilton theorem and it's application.	
12	Lec 34 Lec 35 Lec 36	Real and complex form of Fourier series; Finite transform	
13	Lec 37 Lec 38 Lec 39	Fourier Integral; Fourier transforms	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	inverse Fourier transforms and their uses in solving boundary value problems	

Text and Ref Books:

1. Vector Analysis - Seymour Lipschutz, Dennis Spellman and Murray R. Spiegel, Schaum's outlines
2. Vector Analysis - M. D. Raisinghania
3. Elementary Linear algebra - Wiely, Howard Anton and Chris Rorres

LEVEL-2 TERM-II

CSE-211 3 hours in a week, 3.00 Cr.
Digital Electronics and Pulse Technique

Pre-requisite: EECE-169, CSE-201

Rationale:
To provide the fundamental concepts that underlie the physical operation, analysis and design of digital integrated circuits and an understanding of how to analyse, build and troubleshoot digital circuits.

Objective:

1. To know the operation and the structure of switching circuits.
2. To analyze, design and use of diodes and transistors as a switching circuits.
3. To design and construct the logic families, TTL, ECL, and MOSFET.
4. To understand multivibrators circuits and memory elements.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Know the operation and the structure of switching circuits.
2. Compare and analyze use of diodes and transistors as switching circuits.
3. Design and construct the logic families, like TTL, ECL, and MOSFET.
4. Explain the understanding of multi-vibrators circuits and memory elements.

Course Content:
Diode Logic Gates, Transistor Switches, Transistor Gates, Open Collector and High Impedance Gates, MOS Gates; Digital Logic Families: TTL, ECL, IIL and CMOS Logic with Operation Details; Characteristics of Digital ICs: Propagation delay, Power dissipation, Figure of Merit, Fan out, and Noise immunity; Electronic Circuits for Flip Flops, Counters and Register, Memory Systems, PLAs; S/H circuits, A/D and D/A Converters with Applications; Linear Wave Shaping, Diode Wave Shaping Techniques, Comparator Circuits, Switching Circuits; Pulse Transformers, Pulse Transmission, Pulse Generation; Monostable, Bi-stable and AstableMultivibrator; Schmitt Trigger; Optically Coupled Oscillators; Blocking Oscillators and Time-base Circuit; Timing circuits; Simple voltage sweeps, linear current sweeps.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Know the operation and the structure of switching circuits.	√											
Compare and analyze use of diodes and transistors as switching circuits.			√									
Design and construct the logic families, like TTL, ECL, and MOSFET.			√									
Explain the understanding of multi-vibrators circuits and memory elements.				√								

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Diode Logic Gates, Transistor Switches, Transistor Gates,	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Open Collector and High Impedance Gates MOS Gates	
3	Lec 7 Lec 8 Lec 9	Digital Logic Families: TTL, ECL, IIL CMOS Logic with Operation Details	
4	Lec 10 Lec 11 Lec 12	Characteristics of Digital ICs: Propagation delay Power dissipation, Figure of Merit, Fan out and Noise immunity	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Electronic Circuits for Flip Flops, Counters and Register, Memory Systems, PLAs	
6	Lec 16 Lec 17 Lec 18	S/H circuits A/D and D/A Converters with Applications	
7	Lec 19 Lec 20 Lec 21	Linear Wave Shaping Diode Wave Shaping Techniques	
8	Lec 22 Lec 23 Lec 24	Comparator Circuits, Switching Circuits Pulse Transformers	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Pulse Transmission, Pulse Generation Monostable	
10	Lec 31	Bi-stable and AstableMultivibrator	

	Lec 32 Lec 33	Schmitt Trigger	
11	Lec 28 Lec 29 Lec 30	Optically Coupled Oscillators	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Blocking Oscillators	
13	Lec 37 Lec 38 Lec 39	Time-base Circuit Timing circuits	
14	Lec 40 Lec 41 Lec 42	Simple voltage sweeps Linear current sweeps.	

Text and Ref Books:

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

CSE-212 1.50 hours in a week, 0.75 Cr.

Digital Electronics and Pulse Technique Sessional

Pre-requisite: None

Rationale: To be acquainted with integrated circuits, to design and implement digital circuits and to be able to troubleshoot implemented circuits.

Objective:

1. To provide students the fundamental concepts that underlie the physical operation, analysis and design of digital integrated circuits and systems.
2. To cover the understanding of Digital Electronics and Pulse Techniques in practical.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:
1. Learn the fundamental concepts that underline the physical operation, analysis and design of digital integrated circuits and systems.
2. Discuss the understanding different techniques of Digital Electronics and Pulse in practical and practice.

3. Compare and analyze use of diodes and transistors as switching circuits.

Course Content:
Laboratory works based on CSE-201

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Learn the fundamental concepts that underline the physical operation, analysis and design of digital integrated circuits and systems.									√			
Discuss the understanding different techniques of Digital Electronics and Pulse in practical and practice.								√				
Compare and analyze use of diodes and transistors as switching circuits.						√						

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lab-01	Study of Diode Logic (DL) Circuits	
2			
3	Lab-02	Study of Diode Transistor Logic (DTL) Circuits	
4			

5	Lab-03	Study of Diode Clipping Circuits	
6			
7	Lab-04	Study of Diode Clamping Circuits	
8			
9	Lab-05	Study of High Pass and Low Pass RC Filter Circuits	
10			
11	Lab-06	Study of Schmitt Trigger	
12			
13	Lab-07	Quiz, Lab Test and Viva	
14			

Text and Ref Books:

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

CSE-214 **3.00 hours in a week, 1.50 Cr.**

Numerical Methods Sessional

Pre-requisite: None

Rationale:

In numerical analysis, a numerical method is a mathematical tool designed to solve numerical problems. The implementation of a numerical method with an appropriate convergence check in a programming language is called a numerical algorithm

Objective:

1. To calculate the solutions of nonlinear equations in one variable
2. To analyse the interpolation and approximation
3. To analyse numerical differentiation and integration
4. To understand direct methods for solving linear systems, numerical solution of ordinary differential equations.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate a familiarity with major algorithms and data structures.
2. Write rigorous correctness proof and analyze the running time of the advanced algorithms and data structures for some classic problems;
3. Apply important algorithmic design paradigms and methods of analysis.
4. Synthesize efficient algorithms and data structures in common engineering design situations.

Course Content:

Introduction; Mathematical Model. Sources of errors, their propagation and the idea of conditioning. Solution of algebraic and transcendental equations: Iterative methods for root finding. Rates of convergence. False Position method, Newton-Rhapson method; Solution of simultaneous linear equations: Gauss-Jordan Elimination method, Choleski's process; Dolittle and Crout factorization; Interpolation: diagonal and horizontal difference, differences of a polynomial, Newton's formula for forward and backward interpolation, Spline interpolation; Integration: Gauss quadrature formula, Trapezoidal rule, Simpson's rules, Weddle's rule; Solution of ordinary differential equations: Euler's method, Picard's method, Milne's method, Taylor's series method, Runge-Kutta method; Least squares

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate a familiarity with major algorithms and data structures.									√			
Write rigorous correctness proof and analyze the running time of the advanced algorithms and data structures for some classic problems						√						
Apply important algorithmic design paradigms and methods of analysis.									√			
Synthesize efficient algorithms and data structures in common engineering design situations.											√	

Lecture Schedule

Week	**Lecture**	**Topics**
1	Lec 1 Lec 2 Lec 3	Introduction; Mathematical Model. Sources of errors, their propagation and the idea of conditioning
2	Lec 4 Lec 5 Lec 6	Solution of algebraic and transcendental equations: Iterative methods for root finding
3	Lec 7 Lec 8 Lec 9	Rates of convergence. False Position method, Newton-Rhapson method
4	Lec 10 Lec 11 Lec 12	Solution of simultaneous linear equations: Gauss-Jordan Elimination method

5	Lec 13 Lec 14 Lec 15	Choleski's process; Dolittle and Crout factorization
6	Lec 16 Lec 17 Lec 18	Interpolation: diagonal and horizontal difference, differences of a polynomial
7	Lec 19 Lec 20 Lec 21	**Online 1**
8	Lec 22 Lec 23 Lec 24	Newton's formula for forward and backward interpolation, Spline interpolation
9	Lec 25 Lec 26 Lec 27	Integration: Gauss quadrature formula
10	Lec 31 Lec 32 Lec 33	Trapezoidal rule, Simpson's rules, Weddle's rule
11	Lec 28 Lec 29 Lec 30	Solution of ordinary differential equations: Euler's method, Picard's method, Milne's method
12	Lec 34 Lec 35 Lec 36	Taylor's series method, Runge-Kutta method; Least squares
13	Lec 37 Lec 38 Lec 39	**Online 2**
14	Lec 40 Lec 41 Lec 42	**Quiz / Viva**

Text and Ref Books:

1. Data Structures - Reingold and Hansen
2. Data structures and algorithm – Hopcroft, Ullman
3. Data Structures and Algorithms in Java - Michael T. Goodrich, Roberto Tamassia
4. Introduction to Algorithms - T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, MIT Press

CSE-215 — 3 hours in a week, 3.00 Cr.
Data Structures and Algorithms –II

Pre-requisite: CSE-101, CSE-203

Rationale:
To get basic idea about algorithmic techniques and computational problems arising frequently in practical applications: sorting and searching, divide and conquer, greedy algorithms, dynamic programming.

Objective:
1. To introduce with major algorithms and data structures.
2. To be able to proof correctness of theorem and to analyze the running time of the advanced algorithms and data structures for some classic problems
3. To illustrate important algorithmic design paradigms and methods of analysis.
4. To synthesize efficient algorithms and data structures in common engineering design situations.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Demonstrate a familiarity with major algorithms and data structures.
2. Write rigorous correctness proof and analyze the running time of the advanced algorithms and data structures for some classic problems.
3. Illustrate important algorithmic design paradigms and methods of analysis.
4. Synthesize efficient algorithms and data structures in common engineering design situations.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate a familiarity with major algorithms and data structures.	√											

Write rigorous correctness proof and analyze the running time of the advanced algorithms and data structures for some classic problems.		√										
Illustrate important algorithmic design paradigms and methods of analysis.				√								
Synthesize efficient algorithms and data structures in common engineering design situations.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Algorithms	
2	Lec 4 Lec 5 Lec 6	Correctness proof and techniques for analysis of algorithms	
3	Lec 7 Lec 8 Lec 9	Master Theorem	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Divide and conquer	
5	Lec 13 Lec 14 Lec 15	Greedy method	
6	Lec 16 Lec 17 Lec 18	Dynamic programming	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Basic search and traversal technique	
8	Lec 22 Lec 23 Lec 24	Topological sorting, connected components	
9	Lec 25 Lec 26 Lec 27	Spanning trees, shortest paths	
10	Lec 31 Lec 32 Lec 33	Flow algorithms	**Class Test 3**
11	Lec 28 Lec 29 Lec 30	NP-completeness, NP-hard and NP-complete problems	
12	Lec 34 Lec 35	Coping with hardness: Back tracking	**Class Test 4**

	Lec 36		
13	Lec 37 Lec 38 Lec 39	Coping with hardness: Branch and bound	
14	Lec 40 Lec 41 Lec 42	Approximation algorithms	

Text and Ref Books:

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

CSE-216 — 3 hours in a week, 1.50 Cr.

Data Structures and Algorithms-II Sessional

Pre-requisite: None

Rationale:
To practically implement basic algorithms, such as sorting, finding shortest paths, basic data structures, as well as to analyze the runtime and memory use.

Objective:

1. General Understanding of Basic Algorithm.
2. Developing Programming Skills for Solving Real Time Problem using Algorithm
3. Understand the fundamentals of static and dynamic data structures and relevant standard algorithms.
4. Demonstrate advantages and disadvantages of specific algorithms.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss the understanding of the concepts of linear data structures, non-linear data structures, sorting, and the concepts of balanced search tress, indexing, hashing and graph structure.

2. Implement the data structures in case of different problems in programming language.
3. Expose to the various algorithm design and analysis techniques.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss the understanding of the concepts of linear data structures, non-linear data structures, sorting, and the concepts of balanced search tress, indexing, hashing and graph structure.						√						
Implement the data structures in case of different problems in programming language.											√	
Expose to the various algorithm design and analysis techniques.									√			

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Sorting Algorithm Implementation (Bubble Sort, Insertion Sort, Heap Sort)	
2	Lec 4 Lec 5 Lec 6	Implementing BFS (Breadth First Search) & DFS (Depth First Search) Algorithms by Solving Real Time Problem	
3	Lec 7 Lec 8 Lec 9	Implementation of Greedy Algorithms (Kruskal)	
4	Lec 10 Lec 11 Lec 12	Implementation of Greedy Algorithms (Prims)	
5	Lec 13 Lec 14 Lec 15	Implementation of Graph Algorithm (Dijkstra)	
6	Lec 16 Lec 17 Lec 18	Implementation of Graph Algorithm (Bellman Ford)	
7	Lec 19 Lec 20 Lec 21	Dynamic Programming Algorithm Implementation (Matrix Chain Multiplication)	
8	Lec 22 Lec 23 Lec 24	Online-01	
9	Lec 25 Lec 26 Lec 27	Dynamic Programming Algorithm Implementation (Longest Common Subsequence)	
10	Lec 31 Lec 32 Lec 33	Implementing 0/1 Knapsack Algorithm	
11	Lec 28 Lec 29 Lec 30	Divide and Conquer: Merge Sort, Quick Sort or any others	
12	Lec 34 Lec 35 Lec 36	Implementation of Floyd Warshall Algorithm	
13	Lec 37 Lec 38 Lec 39	Quiz	
14	Lec 40 Lec 41 Lec 42	Online-02	

Text and Ref Books:

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

CSE-217 — 3 hours in a week, 3.00 Cr.
Theory of Computation

Pre-requisite: None

Rationale:
To learn how problems can be efficiently solved on a model of computation using algorithms and the elementary ways in which a computer works.

Objective:
1. Understand the mathematical foundations of computation including automata theory.
2. Have a solid foundation of the theory of formal languages and grammars.
3. Analyze and design finite automata, pushdown automata, Turing machines, formal languages and languages, and grammars.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Identify the mathematical foundations of computation including automata theory.
2. Able to define foundation of the theory of formal languages, grammars, notions of algorithm, decidability, complexity, and computability.
3. Correlate and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.
4. Enhance one's ability to explain and conduct mathematical proofs for computation and algorithms.

Course Content:
Finite automata: deterministic finite automata, nondeterministic finite automata, equivalence and conversion of deterministic and nondeterministic finite automata, pushdown automata; Context free languages; Context free grammars, Chomsky normal form, Greibach Normal Form; Pushdown automata; Regular languages: regular expressions, nonregular languages, the pumping lemma; Turing Machines: basic machines, configuration, computing with Turing machines, combining Turing machines; Undecidability.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Identify the mathematical foundations of computation including automata theory.	√											
2. Able to define foundation of the theory of formal languages, grammars, notions of algorithm, decidability, complexity, and computability.		√										
3. Correlate and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.			√									
4. Enhance one's ability to explain and conduct mathematical proofs for computation and algorithms.						√						

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Automata, Computability, and Complexity, Mathematical Notation and Terminology, Sets, Sequences and Tuples, Functions and Relations, Strings and Languages, Definitions, Theorems and Proofs	
2	Lec 4 Lec 5 Lec 6	Finite Automata, Formal Definition of a Finite Automaton	**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Examples ofFiniteAutomata,Formal Definition of Computation	
4	Lec 10 Lec 11 Lec 12	Designing Finite Automata, The Regular Operations	
5	Lec 13 Lec 14 Lec 15	Nondeterminism, Equivalence of NFAs and DFAs	
6	Lec 16 Lec 17 Lec 18	Closure under the Regular Operations, Regular Expressions, Formal Definition of a Regular Expression,	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Non-regular Languages, The Pumping Lemma for Regular Languages.	

8	Lec 22 Lec 23 Lec 24	Context-Free Languages, Context-Free Grammars	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Formal Definition of CFG, Examples of CFG, Designing CFG	
10	Lec 31 Lec 32 Lec 33	Ambiguity, Chomsky Normal Form.	
11	Lec 28 Lec 29 Lec 30	Formal Definition of a Pushdown Automaton	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Examples of Pushdown Automata.	
13	Lec 37 Lec 38 Lec 39	Formal Definition of a Turing Machine	
14	Lec 40 Lec 41 Lec 42	Examples of Turing Machines	

Text and Ref Books:

1. Introduction to the Theory of Computation (3rd ed) - Michael Sipser (2012)
2. Introduction to Automata Theory, Languages, and Computation. Addison (3rd ed) - J. E. Hopcroft; R. Motwani; J. D. Ullman (2006)
3. Elements of the Theory of Computation (2nded) - H. R. Lewis; C. H. Papadimitriou (1997)

CSE-220 3 hours in a week, 1.50 Cr.
Object Oriented Programming language Sessional-II

Pre-requisite: None

Rationale:
To have knowledge about Inheritance, Polymorphism, Encapsulation to do programming in a effective manner and solve practical life problems by building real-time projects.

Objective:

1. To learn the concept of OOP with a pure object oriented programming language (Java).

2. To learn how to use advance programming features such as GUI design, exception handling and multithreading.
3. To learn how to design and develop a complete real world software solution.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Identify the concept of OOP with a pure object oriented programming language (Java).
2. Identify and express how to use advance programming features such as GUI design, exception handling and multi-threading.
3. Demonstrate how to design and develop a complete real world software solution.

Course Content:
Laboratory works based on CSE-205 (JAVA)

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify the concept of OOP with a pure object oriented programming language (Java).												√
Identify and express how to use advance programming features such as GUI design, exception handling and multi-threading.											√	
Demonstrate how to design and develop a complete real world software solution.											√	

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1	Lec 1 Lec 2 Lec 3	Fundamental Programming Structures in Java; Object Design and Programming	

2	Lec 4 Lec 5 Lec 6	with Java, Garbage Collector, Java Interfaces; Java Swing (GUI)	
3	Lec 7 Lec 8 Lec 9	Java Array; String, StringBuffer, StringBuilder in Java, Online	
4	Lec 10 Lec 11 Lec 12		
5	Lec 13 Lec 14 Lec 15	Java IO; Java Collections, Exception Handling; 50% Project Update	
6	Lec 16 Lec 17 Lec 18		
7	Lec 19 Lec 20 Lec 21	Java concurrency; Generic Classes and Methods, Quiz	
8	Lec 22 Lec 23 Lec 24	Project Submission Fundamental Programming Structures in Java; Object Design and Programming with Java, Garbage Collector	
9	Lec 25 Lec 26 Lec 27		
10	Lec 31 Lec 32 Lec 33	Java Interfaces; Java Swing (GUI) Java Array; String, StringBuffer, StringBuilder in Java	
11	Lec 28 Lec 29 Lec 30		
12	Lec 34 Lec 35 Lec 36	Online, Java IO; Java Collections	
13	Lec 37 Lec 38 Lec 39		
14	Lec 40 Lec 41 Lec 42	Exception Handling; 50% Project Update	

Text and Ref Books:

1. Java, The Complete Reference (9th ed) - Herbert Schildt (2014)

CSE-224 **1.50 hours in a week, 0.75 Cr.**

Advanced Programming Language Sessional

Pre-requisite: None

Rationale:
To be able to solve advanced level problems and develop real time projects professionally.

Objective:

1. To give idea about advanced level programming.
2. To prepare students for the advanced level works of industry
3. To design real time projects
4. To increase practical knowledge to identify the relative merits of different algorithmic designs, programming constructs and data structures

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Identify advance programming language and technique to solve complex problems, to design real time projects and to increase the depth of knowledge in programming.
2. Practice good programming style and identify the impact of style on developing and maintaining programs.
3. Illustrate practical knowledge to identify the relative merits of different algorithmic designs, programming constructs and data structures.

Course Content:
Laboratory works based on current industry requirement of advanced level programming language.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Identify advance programming language and technique to solve complex problems, to design real time projects and to increase the depth of knowledge in programming.									√			
Practice good programming style and Identify the impact of style on developing and maintaining programs.											√	
Illustrate practical knowledge to identify the relative merits of different algorithmic designs, programming constructs and data structures.												√

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Project Proposal	
2	Lec 4 Lec 5 Lec 6	Concurrent programming (thread and processes)	
3	Lec 7 Lec 8 Lec 9	Asynchronous and reactive concurrent programming	
4	Lec 10 Lec 11 Lec 12	Computation complexity	
5	Lec 13 Lec 14 Lec 15	Memory consumption	
6	Lec 16 Lec 17 Lec 18	Dynamic programming (top-down/bottom-up approach)	
7	Lec 19 Lec 20 Lec 21	Operational and denotational program semantics	
8	Lec 22 Lec 23 Lec 24	Presentation on Project Update	
9	Lec 25 Lec 26 Lec 27	Higher order functions, lazy and eager evaluation	

10	Lec 31 Lec 32 Lec 33	Advanced object-oriented topics (structural typing, dynamic type checking, mixins)	
11	Lec 28 Lec 29 Lec 30	Integration of functional programming and object-oriented programming	
12	Lec 34 Lec 35 Lec 36	Information security and flow control	
13	Lec 37 Lec 38 Lec 39	Quiz and Viva	
14	Lec 40 Lec 41 Lec 42	Final Project Submission	

Text and Ref Books:

1. The next 700 programming languages - Peter J. Landin (1966).

HUM- 2XO 2 hours in a week, 2.00 Cr.

Option-I

MATH-247 3 hours in a week, 3.00 Cr.
Mathematics-IV (Complex Variable, Laplace Transform and Statistics)

Pre-requisite: None

Rationale:
To solve complex mathematical problems and analyze statistical data.

Objective:

1. To understand complete concept about complex functions.
2. To evaluate the integrals of complex functions.
3. To expand and analysis the complex functions.
4. To understand the integral transform and invert on large class of functions.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Explain complete concept about complex functions.
2. Measure the integrals of complex functions.
3. Expand and determine the complex functions.
4. Explain the integral transform and invert on large class of functions.

Course Content:

Complex Variable: Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, differentiation and the Cauchy Riemann equations. Line integral of complex functions, Cauchy's Integral Formula.

Laplace Transform: Definition. Laplace transforms of some elementary functions. Sufficient conditions for existence of Laplace transform. Laplace transforms of derivatives. The unit step function. Periodic function, some special theorems on Laplace transform. Inverse Laplace transform and its properties: Partial fractions, Heaviside expansion formula, Convolution theorem.

Statistics: Introduction, Measures of central tendency and standard deviation; moments, skewness and kurtosis; elementary probability theory and discontinuous probability distribution; continuous probability distributions; elementary sampling theory, estimation.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain complete concept about complex functions.	√											
Measure the integrals of complex functions.				√								
Expand and determine the complex functions.				√								
Explain the integral transform and invert on large class of functions.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Complex number system, General functions of a complex variable	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Limits and continuity of a function of complex variable and related theorems	
3	Lec 7 Lec 8 Lec 9	Differentiation and the Cauchy Riemann equations	
4	Lec 10 Lec 11 Lec 12	Line integral of complex functions, Cauchy's Integral Formula	**Class Test 2**

5	Lec 13 Lec 14 Lec 15	Laplace Transform Definition. Laplace transforms of some elementary functions.	
6	Lec 16 Lec 17 Lec 18	Sufficient conditions for existence of Laplace transform.	
7	Lec 19 Lec 20 Lec 21	Inverse Laplace transforms and Laplace transforms of derivatives.	
8	Lec 22 Lec 23 Lec 24	The unit step function, Periodic function	
9	Lec 25 Lec 26 Lec 27	Some special theorems on Laplace transforms, Partial fraction	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Solutions of differential equations by Laplace transform.	
11	Lec 28 Lec 29 Lec 30	Evaluation of improper Integrals by Laplace transform.	
12	Lec 34 Lec 35 Lec 36	Introduction, Measures of central tendency and standard deviation, moments, skewness and kurtosis	
13	Lec 37 Lec 38 Lec 39	Elementary probability theory and discontinuous probability distribution	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Continuous probability distributions; elementary sampling theory, estimation	

Text and Ref Books:

1. Complex variable (2nd ed) – Schaum's Out-line Series by Spiegel (2009)
2. Complex Analysis – Prof. Haridashalder & Dr. Md. Amirul Islam
3. Schaum's Outline of Theory and Problems of Laplace Transforms - Murray R. Spiegel (1965)
4. Advanced Engineering Mathematics (10th ed) - Erwin Kreyszig
5. Statistics- An introduction to statistical learning - Robert Tibshirani, Trevor Hastie

LEVEL-3, TERM-I

CSE-301 3 hours in a week, 3.00 Cr.

Database Management Systems

Pre-requisite: None

Rationale:
This course is designed to introduce the basic concepts of database, learn the foundations of database systems, focusing on basics such as the relational algebra and data model, schema normalization, query optimization, and transactions.

Objective:

1. Understand the basic concepts and appreciate the applications of database systems.
2. Know the basics of SQL and construct queries using SQL.
3. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
4. Be familiar with the relational database theory, and be able to write relational algebra expressions for queries.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe the basic concepts and appreciate the applications of database systems.
2. Illustrate the basics of SQL and construct queries using SQL.
3. Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
4. Be familiar with the relational database theory and be able to write relational algebra expressions for queries.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe the basic concepts and appreciate the applications of database systems.	√											
Illustrate the basics of SQL and construct queries using SQL.	√											
Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.	√											
Be familiar with the relational database theory and be able to write relational algebra expressions for queries.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction of database systems	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Models: Entity-Relationship model, Relational model	
3	Lec 7 Lec 8 Lec 9	Relational algebra	
4	Lec 10 Lec 11 Lec 12	SQL	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Advanced SQL, Some applications using SQL	
6	Lec 16 Lec 17 Lec 18	Integrity constraint	
7	Lec 19 Lec 20 Lec 21	Relational database design	
8	Lec 22 Lec 23 Lec 24	File organization and retrieval, file indexing and hashing	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Transaction manager	
10	Lec 31 Lec 32 Lec 33	Concurrency controller, Recovery manager	

11	Lec 28 Lec 29 Lec 30	Security system, Database administration	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Introduction to advanced database management systems: distributed database, parallel database	
13	Lec 37 Lec 38 Lec 39	Data mining and warehousing, multimedia	
14	Lec 40 Lec 41 Lec 42	Object-oriented, object-relational, real-time database	

Text and Ref Books:

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

CSE-302 — 3 hours in a week, 1.50 Cr.

Database Management Systems Sessional

Pre-requisite: None

Rationale:
This course is designed to introduce the basic concepts of database, learn how to design database and gain first-hand experience through developing a real world e- commerce database application in a term project. Also, to learn the design of a database starting from the conceptual design to the implementation of database schemas and user interfaces to a database..

Objective:
1. To introduce the basic concepts of database.
2. Developing a real world database application.
3. To learn the design of a database starting from the conceptual design to the implementation of database schemas and user interfaces to a database.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate the knowledge in projects with a commercial relational database system (Oracle) and design a team-based project.
2. Utilize the database design principles, SQL and PL SQL.
3. Demonstrate the relational database theory and be able to write relational algebra expressions for queries.

Course Content:

Introduction, Oracle Installation, Authentication, Security, Table Creation, SQL, Simple Query, Data Expressions, Join, Constraints, Advanced Query (GROUP Function etc.), Sub-queries, Single-row function, Numeric function, Manipulation function, Conversion function, Nesting of function, Abstract data type, Database Trigger/ Procedure, PL/SQL Packages, Indexing, View, Introduction to PL/SQL

Teaching-learning and Assessment Strategy:

Lectures, Class Performance, Project, Quiz, Viva, Lab Exam

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate the knowledge in projects with a commercial relational database system (Oracle) and design a team-based project.									√			
Utilize the database design principles, SQL and PL SQL.									√			
Demonstrate the relational database theory and be able to write relational algebra expressions for queries.									√			

Lecture Schedule

Week	Lecture	Topics	Project
1	Lec 1	Introduction, Oracle Installation, Authentication, Security	Project group distribution Project assignment
2	Lec 2	Table Creation, SQL	Presentation on the project proposal with submission of a report
3	Lec 3	Simple Query, Data Expressions etc.	Submission of the E- R diagram, Schema diagram
4	Lec 4	JOIN Operations	
5	Lec 5		Project Update - 01
6	Lec 6	Online Exam – 1	
7	Lec 7	Constraints	
8	Lec 8	Advanced Query (GROUP Function etc.), Sub-queries	
9	Lec 9	Single-row function, Numeric function, Manipulation function, Conversion function, Nesting of function, Abstract data type etc.	Project Update - 02
10	Lec 10	Online Exam – 2	
11	Lec 11	Database Trigger/ Procedure	
12	Lec 12	PL/SQL Packages, Indexing, View	
13	Lec 13	Introduction to PL/SQL	
14	Lec 14	Additional Online Exam	

Text and Ref Books:

1. Database System Concept, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Fourth edition
2. The Complete Reference JAVA2, Herbert Schildt
3. Microsoft C# Professional Projects,Geetanjali Arora, B. Aiaswamy, Nitin Pandey
4. The Complete Reference PHP 5.2 Steven Holzner

CSE-303 — 3 hours in a week, 3.00 Cr.

Compiler

Pre-requisite: CSE-217

Rationale:
To teach the students the basic techniques that underlie the practice of various phases of Compiler construction.

Objective:
1. To introduce the theory and tools that can be employed in order to perform syntax-directed translation of a high-level programming language into an executable code.
2. To understand the role of compilers in programming languages.
3. To understand various stages in compilation process.
4. To provide knowledge on designing scanners and parsers using tools.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Describe the role and purpose of compilers in programming languages.
2. Discuss the stages in compilation process.
3. Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation and specify and analyze the lexical, syntactic and semantic structures of advanced language features.
4. Design scanners and parsers using tools, and build abstract syntax trees in connection with this.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe the role and purpose of compilers in programming languages.	√											

Discuss the stages in compilation process.	√											
Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation and specify and analyze the lexical, syntactic and semantic structures of advanced language features.		√										
Design scanners and parsers using tools, and build abstract syntax trees in connection with this.			√									

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction, Language Processors, The Structure of a Compiler	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, Transition Diagram	
3	Lec 7 Lec 8 Lec 9	Recognition of Reserved Words and Identifiers, Architecture of a Transition-Diagram-Based Lexical Analyzer, The Lexical-Analyzer Generator Lex	
4	Lec 10 Lec 11 Lec 12	Top-Down Parsing, Predictive Parsing	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Designing a Predictive Parser, Left Recursion, The Role of the Parser, Representative Grammars, Syntax Error Handling, Writing a Grammar	
6	Lec 16 Lec 17 Lec 18	Elimination of Left Recursion, Left Factoring, Top-Down Parsing, First and Follow	
7	Lec 19 Lec 20 Lec 21	LL (1) Grammars, Construction of Predictive Parsing Table, Nonrecursive Predictive Parsing, Parsers Generators	
8	Lec 22 Lec 23 Lec 24	Syntax-Directed Definitions, Inherited and Synthesized Attribute, Evaluating an SDD at the Nodes of a Parse Tree, Dependency Graph	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Ordering the Evaluation of Attributes, S-Attributed Definitions, L-Attributed Definitions, Semantic Rules with Controlled Side Effect, Applications of Syntax Directed Translation	
10	Lec 31 Lec 32 Lec 33	Variants of Syntax Tree, Directed Acyclic Graphs for Expressions, The Value Number Method for Constructing DAG's, Three-Address Code, Addresses and Instructions	

11	Lec 28 Lec 29 Lec 30	Quadruples, Triples, Static Single-Assignment Form, Types and Declarations,	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Storage Organization, Static VS Dynamic Storage Allocation, Stack Allocation of Space, Activation Trees, Activation Records	
13	Lec 37 Lec 38 Lec 39	Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Static Allocation, Optimization of Basic Blocks	
14	Lec 40 Lec 41 Lec 42	Peephole Optimization, Optimization of basic blocks-Loops in flow graphs; Introduction to global data-flow analysis, Code improving transformations	

Text and Ref Books:

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

CSE-304 — 1.50 hours in a week, 0.75 Cr.

Compiler Sessional

Pre-requisite: None

Rationale:
To implement tokenizer, arithmetic calculator and to able to write the code by using Flex and Bison.

Objective:
1. To learn to implement different phases of a compiler.
2. To learn the use of Flex and Bison tools used for designing a compiler.
3. To understand the different types of parsing techniques and to solve the problem.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Use the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code.
2. Describe the working of lex and yacc compiler for debugging of programs.
3. Discuss the new tools and technologies used for designing a compiler.

Course Content:
Symbol Table, Tokenizer, Tokenizer Using Flex, Arithmetic Calculator using Bison, Intermediate Code Generator (Flex + Bison).

Teaching-learning and Assessment Strategy:
Lab performances, Lab Report/Assignment/Presentation, Lab Test/ Quiz.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Use the basic techniques of compiler construction and tools that can used to perform syntax-directed translation of a high-level programming language into an executable code.						√						
Describe the working of lex and yacc compiler for debugging of programs.									√			
Discuss the new tools and technologies used for designing a compiler.											√	

Lecture Schedule:

Week	Lecture	Topics
1+ 2	Lab 1+2	Symbol Table
3+ 4	Lab 3+ 4	Tokenizer
5+ 6	Lab 5+6	Tokenizer Using Flex
7+ 8	Lab 7+ 8	Arithmetic Calculator using Bison
9+ 10	Lab 9+ 10	Intermediate Code Generator (Flex + Bison)
11+ 12	Lab 11+ 12	Online
13	Lab 13	Quiz
14	Lab 14	Viva

Text and Ref Books:

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

CSE-305 — 4 hours in a week, 4.00 Cr.

Microprocessors, Micro-controllers and Assembly Language

Pre-requisite: CSE-201

Rationale:
This course introduces basics of assembly language, microprocessor architecture, and discusses different interfaces and the design of systems based on microprocessors and microcontrollers.

Objective:

1. To achieve knowledge on the low level language of microprocessor
2. To provide an understanding of microprocessor-based systems and their use in instrumentation, control and communication systems.

3. To Investigate microprocessor-based systems, produce software for a microprocessor-based system, interface microprocessor-based systems and understand usage of programmable logic controllers

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Understand how the high level language is converted to low level languages and how a processor executes a program line by line.
2. Work with basic microprocessors using assembly language.
3. Understand the basic method of how a microcomputer works with its associate components.
4. Design 8051 microcontroller based system.

Course Content:

Assembly Language: System Architecture for Assembly language; Assembly programming basics; Assembly Addressing modes; Assembly instruction types and their formats: Arithmetic, Logical, Transfer control and conditional processing, Stacks, branches, String processing, subroutine and parameter passing, macros, Input/output; Interrupts, ; Procedures, file system and file I/O handling.

Microprocessors and Micro-controllers: Introduction to Microprocessor and Microcontroller. Architectural overview of Microprocessor and its operation, Common instruction types, addressing modes. Intel 8086 Microprocessor : Internal architecture, register structure, programming model, addressing modes, instruction set; I/O Pin diagram and Control signals; I/O port organization and accessing; Cache Memory, TLB Structure; Memory Management in Intel 80X86 Family; segmentation and Real Mode Memory Management. Intel 80186, 80386 and 80486 segments register formats, Paged memory operation. Linear to physical address translation; Arithmetic co-processor; Interrupts and Exception in Intel 80X86 families of processors, type of Interrupts, Interrupts in real mode and protected mode, Interrupt descriptor tables, Interrupts Priorities; Input and Output : IO address spaces, Port organization, Memory mapped IO, Hand-shaking IO instruction, Keyboard-Display interface Timer handler, Microcontrollers: Architecture of 8051, memory organization, special function register,I/O ports, Special function registers.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Demonstrate how the high level language is converted to low level languages and how a processor executes a program line by line.	√											

Develop using basic microprocessors using assembly language.	√											
Describe the basic method of how a microcomputer works with its associate components.		√										
Develop 8051 microcontroller based system.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3 Lec 4	System Architecture for Assembly language; Assembly programming basics; Assembly Addressing modes	
2	Lec 5 Lec 6 Lec 7 Lec 8	Assembly instruction types and their formats: Arithmetic, Logical, Transfer control and conditional processing,	**Class Test 1**
3	Lec 9 Lec 10 Lec 11 Lec 12	Stacks, branches, String processing, subroutine and parameter passing	
4	Lec 13 Lec 14 Lec 15 Lec 16	Macros, Input/output; Interrupts, Procedures, file system and file I/O handling.	
5	Lec 17 Lec 18 Lec 19 Lec 20	Introduction to Microprocessor and Microcontroller. Architectural overview of Microprocessor and its operation, Common instruction types, addressing modes.	**Class Test 2**
6	Lec 21 Lec 22 Lec 23 Lec 24	Intel 8086 Microprocessor : Internal architecture, register structure, programming model,	
7	Lec 25 Lec 26 Lec 27 Lec 28	Addressing modes, instruction set; I/O Pin diagram and Control signals; I/O port organization and accessing;	
8	Lec 29 Lec 30 Lec 31 Lec 32	Cache Memory, TLB Structure; Memory Management in Intel 80X86 Family; segmentation and Real Mode Memory Management.	**Class Test 3**
9	Lec 33 Lec 34 Lec 35 Lec 36	Intel 80186, 80386 and 80486 segments register formats, Paged memory operation	**Class Test 4**

10	Lec 37 Lec 38 Lec 39 Lec 40	Paged memory operation. Linear to physical address translation; Arithmetic co-processor;	
11	Lec 41 Lec 42 Lec 43 Lec 44	Interrupts and Exception in Intel 80X86 families of processors, type of Interrupts, Interrupts in real mode and protected mode, Interrupt descriptor tables, Interrupts Priorities;	
12	Lec 45 Lec 46 Lec 47 Lec 48	Interrupts Priorities; Input and Output : IO address spaces, Port organization, Memory mapped IO, Hand-shaking IO instruction	
13	Lec 49 Lec 50 Lec 51 Lec 52	Keyboard-Display interface Timer handler, Microcontrollers:	**Class Test 5**
14	Lec 53 Lec 54 Lec 55 Lec 56	Architecture of 8051, memory organization, special function register,I/O ports, Special function registers.	

Text and Ref Books:

1. Assembly Language Programming and Organization of the IBM PC--Ytha Yu, Charles Marut
2. The Intel Microprocessors - Barry B Brey
3. Microprocessors and Interfacing - Douglas V. Hall
4. Microprocessors and Microcomputer- based system design -Mohamed Rafiquzzaman.
5. 8051 Microcontroller-Internals, Instructions, Programming& Interfacing by Subrata Ghoshal

CSE-306 **3 hours in a week, 1.50 Cr.**

Microprocessors, Micro-controllers and Assembly Language Sessional

Pre-requisite: None

Rationale:
This course introduces basics of assembly language, microprocessor architecture, and discusses different interfaces and the design of systems based on microprocessors and microcontrollers.

Objective:

1. To achieve knowledge on the low level language of microprocessor
2. To provide an understanding of microprocessor-based systems and their use in instrumentation, control and communication systems.
3. To Investigate microprocessor-based systems, produce software for a microprocessor-based system, interface microprocessor-based systems and understand usage of programmable logic controllers

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand how the high level language is converted to low level languages and how a processor executes a program line by line.
2. Work with basic microprocessors using assembly language.
3. Understand the basic method of how a microcomputer works with its associate components.
4. Design 8051 microcontroller based system.
5. Know about different family and generation of microprocessors and microcontrollers.

Course Content:

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

Basic Idea of MDA 8086; LED, Seven Segment display, LCD, Keyboard, Motor, Dot matrix Interface with 8086; Basic idea of ATMEGA 16 microcontroller and simulation

Teaching-learning and Assessment Strategy:
Lectures, Class Performance, Project, Quiz, Viva, Lab Exam

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe how the high level language is converted to low level languages and how a processor executes a program line by line and solve problems using to low level languages.										√		
Work with basic microprocessors using assembly language.						√						
Work on Group Project based on basic micro-controllers with presentation.								√				

Lecture Schedule

Week	Lecture	Topics
1	Lec 1	**Basic of Assembly Language** - Compilation, input, output, variables, basic instructions, memory model, data segment, stack segment, code segment, Input Output Instruction
2	Lec 2	**Flow Control Instruction** - Conditional and unconditional jump instructions, If-then-else, case, for loop, while loop, repeat loop
3	Lec 3	**Logic, Shift and Rotate Instructions** - AND, OR, XOR, complement, shift left, shift right, rotate left, rotate right, rotate carry left, rotate carry right, Binary , Hexa Input Output

4	Lec 4	**Stack and Procedure** - Push, Pushf, Pop, Popf **Multiplication and Division** – Mul, IMul, Div, IDiv
5	Lec 5	**Array and Addressing moods –** 1D Array, DUP operator, Addressing mood, register indirect mood
6	Lec 6	**String Instructions** - Moving string, load string, scan string, compare string **File Operations** – File errors, opening and closing a file, reading a file, writing a file
7	Lec 7	Online Exam
8	Lec 8	Project Idea
9	Lec 9	Basic Idea of MDA 8086 LED and Seven Segment display interface
10	Lec 10	Operation of DOT matrix using 8086 kit LCD interface with 8086
11	Lec 11	Keyboard interface with 8086 Motor interface with 8086
12	Lec 12	Project Update
13	Lec 13	Lab Exam
14	Lec 14	Final Project Submission Quiz

Text and Ref Books:

1. Assembly Language Programming and Organization of the IBM PC--Ytha Yu, Charles Marut
2. The Intel Microprocessors - Barry B Brey
3. Microprocessors and Interfacing - Douglas V. Hall

CSE-317 3 hours in a week, 3.00 Cr.

Data Communication

Pre-requisite: None

Rationale:

The main course is to learn the working knowledge of data transmission concepts, line control and line sharing and also is to understand the operation of compression optimizing data transfer algorithms.

Objective:

1. Be familiar with modern telecommunications and the architecture of a number of different networks
2. Understand the principles of protocol layering.
3. Apply frequency and time division multiplexing techniques to share network bandwidth among multiple users.
4. Use data compression algorithms to maximize network.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe and explain data communication system and its components.
2. Familiarize students to the digital and analogue representations and channels.
3. Describe the mechanism and techniques of encoding.
4. Introduce students to the general principles of circuit and packet switching.

Course Content:

Introduction: Communication models, data communication tasks, data communication network standards and organization introduction to TCP/IP models. Data Transmission basics: Analog and digital data, spectrum and bandwidth, Transmission impairments, data rate, and channel capacity. Data Encoding, NRZI Manchester and Differential Manchester encoding, ASK, FSK, PSK, QPSK, QAM encoding, speared spectrum technique, Sampling theorem and pulse code modulation techniques and speech digitization. Data Transmission: Asynchronous and synchronous data transmission techniques, error, detection techniques, parity cheeks and CRC error correction and hamming code interfacing and EIA 232D or RS 232c. DSL technology: Data Link Control: Line configurations. Multiplexing: Frequency division multiplexing, international FDM carrier standards, Synchronous time division multiplexing, international TDM carrier standards, statistical time division multiplexing, SONET and SDH.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe and explain data communication system and its components.	√											
Familiarize students to the digital and analogue representations and channels.	√											
Describe the mechanism and techniques of encoding.		√										

Introduce students to the general principles of circuit and packet switching.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction: Communication models, data communication tasks.	
2	Lec 4 Lec 5 Lec 6	Data communication network standards and organization introduction to TCP/IP models.	
3	Lec 7 Lec 8 Lec 9	Data Transmission basics: Analog and digital data, spectrum and bandwidth, Transmission impairments, data rate, and channel capacity.	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Data Encoding, NRZI Manchester and Differential Manchester encoding, ASK, FSK, PSK, QPSK, QAM encoding.	
5	Lec 13 Lec 14 Lec 15	Speared spectrum technique, Sampling theorem and pulse code modulation techniques and speech digitization.	
6	Lec 16 Lec 17 Lec 18	Data Transmission: Asynchronous and synchronous data transmission techniques.	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Error, detection techniques.	
8	Lec 22 Lec 23 Lec 24	Parity cheeks and CRC error correction and hamming code interfacing.	
9	Lec 25 Lec 26 Lec 27	Data Link Control: Line configurations.	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Multiplexing: Frequency division multiplexing, international FDM carrier standards, Synchronous time division multiplexing.	
11	Lec 28 Lec 29 Lec 30	International TDM carrier standards, statistical time division multiplexing, SONET and SDH.	
12	Lec 34 Lec 35 Lec 36	STANDARD ETHERNET: MAC Sublayer, Physical Layer. FAST ETHERNET: MAC Sublayer, Physical Layer. GIGABIT ETHERNET: MAC Sublayer, Physical Layer, Ten-Gigabit Ethernet	**Class Test 4**

13	Lec 37 Lec 38 Lec 39	GIGABIT ETHERNET: MAC Sublayer, Physical Layer, Ten-Gigabit Ethernet	
14	Lec 40 Lec 41 Lec 42	BLUETOOTH: Architecture, Bluetooth Layers	

Text and Ref Books:

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

CSE-318 1.50 hours in a week, 0.75 Cr.

Data Communication Sessional

Pre-requisite: None

Rationale:
The main course is to learn the working knowledge of data transmission concepts, line control and line sharing and also is to understand the operation of compression optimizing data transfer algorithms.

Objective:
1. Understand and explain Data Communications System and its components.
2. Introduce students to the digital and analogue representations and channels.
3. Describe the mechanism and techniques of encoding.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Apply amplitude, frequency and time division multiplexing techniques to share network bandwidth among multiple users.
2. Compare each data transmission methods using both signal processing devices and lab software.
3. Describe the knowledge of data link layer fundamental in error detection, correction and flow control techniques.

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	Marks %
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Apply amplitude, frequency and time division multiplexing techniques to share network bandwidth among multiple users.						√						
Compare each data transmission methods using both signal processing devices and lab software.									√			
Describe the knowledge of data link layer fundamental in error detection, correction and flow control techniques.						√						

Lecture Schedule:

Week	Topics
1 & 2	Introduction to MATLAB / Delta Modulation
3 & 4	Evaluation On Lab-1, AM/FM / AM Modulator & Demodulator
5 & 6	Digital to digital Conversion; Line Coding / DSB-SC and SSB Demodulators
7	**Online-1**
8 & 9	Digital to digital Conversion; Line Coding / FM Modulator and Demodulator
10 & 11	ASK/PSK/FSK
12 & 13	CDMA, Checksum
14	**Viva/Quiz + Online-2**

Text and Ref Books:

4. Data Communication and Networking(4^{th} ed) - Behrouz A Forouzan (2017)
5. Data and Computer Communication - William Stallings
6. Data Communication & Networks – R L Brewster

CSE-323 — 3 hours in a week, 3.00 Cr.

Computer Architecture

Pre-requisite: CSE-201

Rationale:
This course introduces students to the basic concepts of computers, their design and how they work. It encompasses the definition of the machine's instruction set architecture, its use in creating a program, and its implementation in hardware. The course addresses the bridge between gate logic and executable software, and includes programming both in assembly language (representing software) and HDL (representing hardware).

Objective:

1. Developing the basic idea about computer architecture.
2. Learning the techniques of high performance parallel processing system.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand the Overview, Computer System, Arithmetic and logic, Central processing unit and parallel organization.
2. Understand the Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.
3. Able to develop and design an instruction set architecture and subsystems of central processing unit.

Course Content:

Fundamentals of computer Design; Processor Design; Information representation; Measuring performance; Instructions and data access methods: operations and operands of computer hardware, representing instruction, addressing styles; Computer functions and Interconnection Structures; Arithmetic Logic Unit (ALU) operations, floating point operations, designing ALU; Processor design: datapaths - single cycle and multicycle implementations; Control Unit design - hardwired and microprogrammed; Hazards;

Exceptions; Pipeline: pipelined datapath and control, superscalar and dynamic pipelining; RISC Processor, Memory organization: cache, virtual memory, channels; Concepts of DMA and Interrupts; Buses: overview of computer BUS standards; Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.\

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Understand the Overview, Computer System, Arithmetic and logic, Central processing unit and parallel organization.		√										
Understand the Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.	√											
Able to develop and design an instruction set architecture and subsystems of central processing unit.	√											

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Fundamentals of Computer Organization and Architecture: Fundamentals of computer Design, Processor Design	
2	Lec 4 Lec 5 Lec 6	Computer Evolution and Performance, Processor Design	
3	Lec 7 Lec 8 Lec 9	Computer Function and Interconnection: overview of computer BUS standards, Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Cache Memory: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 Cache Organization, ARM Cache Organization	**Class Test 2**
5	Lec 13 Lec 14	Internal Memory : Memory organization, ARM Cache Organization, cache, Error	

	Lec 15	Correction, virtual memory, channels; Concepts of DMA and Interrupts, Advanced DRAM Organization	
6	Lec 16 Lec 17 Lec 18	External Memory: Magnetic Disk, RAID, Solid State Drives, Optical Memory, Magnetic Tape	
7	Lec 19 Lec 20 Lec 21	Input/ Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Processors, The External Interface: Thunderbolt and InfiniBand	
8	Lec 22 Lec 23 Lec 24	Operating System Support: Operating System Overview, Scheduling, Memory Management, Pentium Memory Management, ARM Memory Management	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Number Systems, Computer Arithmetic, Machine Instruction Characteristics, Types of Operands, Types of Operations	
10	Lec 31 Lec 32 Lec 33	Processor Structure and Function; Processor design: datapaths - single cycle and multicycle implementations; Control Unit design - hardwired and microprogrammed; Hazards; Exceptions;	
11	Lec 28 Lec 29 Lec 30	Reduced Instruction Set Computers; RISC Processor, Pipeline: pipelined datapath and control, superscalar and dynamic pipelining;	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Parallel Processing: Instruction-Level Parallelism and Machine Parallelism, Instruction Issue Policy, Register Renaming, Machine Parallelism, Branch Prediction	
13	Lec 37 Lec 38 Lec 39	Superscalar Processors: Superscalar Execution, Superscalar Implementation	
14	Lec 40 Lec 41 Lec 42	Parallel Organization: Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors, Clusters, Nonuniform Memory Access, Vector Computation	

Text and Ref Books:

1. Computer Organization and Architecture - William Stalling
2. Computer Organization and Design - David A Patterso
3. Structured Computer Organization - Andrew S. Tanenbaum

LEVEL-3, TERM-II

CSE-307 **3 hours in a week, 3.00 Cr.**

Operating System

Pre-requisite: None

Rationale:

The Operating System course provides a comprehensive understanding to the modern Operating System. The course begins with the history of operating system and the review of computer hardware and concentrates on operating system concepts, system structure, process and threads, memory management, file system and related security aspects. It also deals with multiprocessor systems, virtualizations and cloud.

Objective:

1. Developing the basic idea about Internals and design principles of OS.
2. Learning the techniques for achieving protection and security in multi-level complex environment.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems. Discuss and apply internal design principles of Operating System.
2. Understanding and analysing process, threads, memory and file management system;
3. Able to develop and design algorithms for deadlock and memory management.

Course Content :

OS Introduction of Operating System, Types of OS; Process: process managements, process states, job and process scheduling, CPU scheduling algorithms, process coordination, critical section problems, semaphores, Inter-Process Communication (IPC), classical IPC problems, multiprocessing and time sharing,; Memory management: swapping, memory allocation schemes, Paging and segmentation, virtual memory, page replacement strategies, working sets, demand paging; Input/output: hardware/software, disk, disk scheduling algorithms, Secondary storage management, terminals, clocks; Deadlock: resource allocation, detection, prevention, avoidance and recovery; File management; Virtualization : Types and techniques for efficient virtualization, memory and i/o virtualizations, virtual appliances, Cloud :clouds as a service, virtual machine migration, Check pointing; Multiple Processor Systems:Multiprocessor, Multicomputer, Distributed Systems, Research on Multiple Processor Systems; Operating system security and protection; case study of some operating systems.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Assessment Method	(100%)
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.	√											
Understanding and analysing process, threads, memory and file management system;		√										
Able to develop and design algorithms for deadlock and memory management.			√									

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction evolution, goals and Components of OS, types of OS	**Class Test 1**

2	Lec 4 Lec 5 Lec 6	Process managements, process states and state transition, process control blocks	
3	Lec 7 Lec 8 Lec 9	Job and process scheduling, scheduling levels, objective and criteria CPU scheduling algorithms	
4	Lec 10 Lec 11 Lec 12	Process coordination, critical section problems, semaphores,	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Language constructs, classical problems of process coordination, Inter-process communication, message and mailbox etc.	
6	Lec 16 Lec 17 Lec 18	Memory management memory allocation schemes, Paging and segmentation, virtual memory	
7	Lec 19 Lec 20 Lec 21	Page replacement strategies, working sets, demand paging	
8	Lec 22 Lec 23 Lec 24	File system functions file organization logical and physical file maps, tree structure file systems,	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	I/O programming Device management techniques. Interrupts processing parallel processing.	
10	Lec 31 Lec 32 Lec 33	Secondary storage management, disk scheduling algorithms	
11	Lec 28 Lec 29 Lec 30	Space allocation, catalogs, file access control mechanism	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Deadlock, deadlock prevention. avoidance direction and recovery	
13	Lec 37 Lec 38 Lec 39	Operating system security, timesharing, Types and techniques for efficient virtualization, memory and i/o virtualizations, virtual appliances	
14	Lec 40 Lec 41 Lec 42	Clouds as a service, virtual machine migration, Check pointing; Multiple Processor Systems: Multiprocessor, Multicomputer, Distributed Systems, Research on Multiple Processor Systems; Operating system security and protection; case study of some operating systems	

Text and Ref Books:

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

CSE-308 1.50 hours in a week, 0.75 Cr.

Operating System Sessional

Pre-requisite: None

Rationale:

Understand the basic components of a computer operating system, and the interactions among the various components on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.

Objective:

1. To learn basic OS concepts and to be familiar with the design principles of Operating System
2. Developing Internal and design principles of Operating System.
3. Be Familiar with the boot loader, kernel and how they works

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Evaluate major operating systems like Windows, Linux.
2. Discuss and apply internal design principles of Operating System.
3. Able to develop and design algorithms for process, thread and memory management.
4. Able to configure system software to enhance system capacity and security.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Assessment Method	**(100%)**
Lab Test	40
Quiz	20
Viva	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Evaluate major operating systems like Windows, Linux.											√	
Discuss and apply internal design principles of Operating System.										√		
Able to develop and design algorithms for deadlock and memory management.							√					
Able to configure system software to enhance system capacity and security.									√			

Lecture Schedule:

Week	**Topics**
1-2	Introduction of Linux Operating System Installation of Linux in various modes Installation of windows application programs on Linux Installation of Linux application programs on Windows Basic Command Line commands
3-4	Playing with Linux Kernels and Office Environments Assigning related Project

5-6	Orientation with Shell Programing
7-8	Introduction with a lightweight open source OS (For e.g., NACHOS) Implementation of Process & Thread Synchronization
9-10	Evaluation on Synchronization Implementation of Memory management
11-12	Evaluation on Memory management
13-14	Quiz & Final Report Submission

Text and Ref Books:

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

CSE-309 — 3 hours in a week, 3.00 Cr.

Computer Network

Pre-requisite: None

Rationale:

Resource sharing, high Reliability, increase in system performance, and security are the main objective.

Objective:

1. Understand the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.
2. Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
3. Design a network routing for IP networks.
4. Demonstrate proper placement of different layers of ISO model and illuminate its function.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss the understanding of the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.
2. Illustrate knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
3. Design network routing for IP networks.
4. Demonstrate proper placement of different layers of ISO model and illuminate its function.

Course Content:

Protocol hierarchies; Data link control: HLDC; DLL in Internet; DLL of ATM; LAN Protocols: Standards IEEE 802; Hubs, Bridges, and Switches, FDDI, Fast Ethernet; Routing Algorithm; Internetworking, WAN; Fragmentation; Firewalls; IPV4, IPV6, ARP, RARP, Mobile IP, Network layer of ATM; Transport Protocols; Transmission Control Protocol: Connection Management, Transmission Policy, Congestion Control, Timer Management; UDP; AAL of ATM; wireless networks, mobile computing, and high speed networks; Gigabit Ethernet; Domain Name System: Name servers; Email and Its privacy; SNMP; HTTP; World Wide Web; Network security: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures, Principles of Reliable Data Transfer, FTP.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss the understanding of the organization of computer networks, factors influencing computer network development and the reasons for having variety of different types of networks.	√											
Illustrate knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.	√											
Design network routing for IP networks.			√									
Demonstrate proper placement of different layers of ISO model and illuminate its function.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction What Is the Internet, Network Edge, Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, Networks Under Attack, History of Computer Networking and the Internet	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Application Layer Principles of Network Applications, The Web and HTTP, File Transfer	
3	Lec 7 Lec 8 Lec 9	Electronic Mail in the Internet, DNS, Peer-to-Peer Applications, Socket Programming	
4	Lec 10 Lec 11 Lec 12	Transport Layer Process to Process Delivery,	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	UDP, TCP, SCTP	
6	Lec 16 Lec 17 Lec 18	Network Layer IPv4 Addresses, Internet Protocol, Internetworking, IPv4	
7	Lec 19 Lec 20 Lec 21	IPv6 Address, Transition from IPv4 to IPv6, Address Mapping, ICMP	
8	Lec 22 Lec 23 Lec 24	Data Link Layer Services Provided by the Link Layer , Link Layer Implementation, Error-Detection and Correction, Parity Checks, Check summing Methods, CRC	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Multiple Access Links and Protocols, Switched Local Area Network, Link Virtualization, Data Center Networking, Retrospective	
10	Lec 31 Lec 32 Lec 33	Wireless and Mobile Networks Wireless Links and Network Characteristics, Cellular Internet Access, Mobility Management: Principles, Mobile IP, Managing Mobility in Cellular Networks, Wireless and Mobility: Impact on Higher-Layer Protocols	
11	Lec 28 Lec 29 Lec 30	Network Security Cryptography, Message Integrity and Digital Signatures, End-Point Authentication, Securing E-Mail, Securing TCP Connections: SSL, Network-Layer Security: IPsec and Virtual Private Networks, Firewalls and Intrusion Detection Systems	**Class Test 4**

12	Lec 34 Lec 35 Lec 36	Network Layer IGMP, ICMPV6, Delivering, Forwarding and Routing Delivery, Forwarding	
13	Lec 37 Lec 38 Lec 39	Unicast Routing Protocols Multicast Routing Protocols	
14	Lec 40 Lec 41 Lec 42	Multimedia Digitizing Audio And Video, Audio And Video Compression, Streaming Stored Audio/Video, Streaming Live Audioivideo, Real-Time Interactive Audioivideo, RTP, RTCP, Voice Over IP Review Class	

Text and Ref Books:

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

CSE-310 3 hours in a week, 1.50 Cr.

Computer Network Sessional

Pre-requisite: None

Rationale:

Apply, discuss, analyze, simulate, and present architectures, applications of different types of computer networks to facilitate communication and resource-sharing among a wide range of users.

Objective:

1. Understand, analyze, simulate, and present architectures of different types of computer networks & develop, and present contemporary and new protocols of computer networks.
2. Understand, Design, analyze different types of Network Layers.
3. Identify applications of computer networks with determining suitable alternatives of the networks.
4. Achieve a basic idea about Cisco Packet tracer, WireShark,Ns2

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss, analyze, simulate, and present architectures of different types of computer networks; develop, and present contemporary and new protocols of computer networks.
2. Describe, design, and analyze different types of network layers.
3. Identify applications of computer networks with determining suitable alternatives of the networks.
4. Apply the basic functionalities of Cisco Packet Tracer, WireShark,NS-2.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Online Test – 1	25
Online Test – 2	25
Viva	10
Class Participation	10
Class Assessment	30
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss, analyze, simulate, and present architectures of different types of computer networks; develop, and present contemporary and new protocols of computer networks.									√			

Describe, design and analyze different types of network layers.											√	
Identify applications of computer networks with determining suitable alternatives of the networks.									√			
Apply the basic functionalities of Cisco Packet Tracer, WireShark,Ns2.											√	

Lecture Schedule

Week	Topics
1	IP Addressing, Basic Configuration of Cisco Packet Tracer
2	Socket Programing
3	Basic Network Configuration (Static) Data
4	Variable Length Subnet Mask (VLSM)
5	RIP, EIGRP
6	Dynamic Host Configuration Protocol (DHCP) , Open Shortest Path First (OSPF)
7	Online-1
8	Physical Network Interface Connection/ Router & Switch Configuration
9	Access Control List (ACL)
10	VLAN, InterVLAN, VTP
11	Information Gathering using Wireshark
12	Introduction to NS2
13	Online-2
14	Quiz

Text and Ref Books:

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

CSE-313 **3 hours in a week, 3.00 Cr.**

Mathematical Analysis for Computer Science

Pre-requisite: None

Rationale:

To achieve knowledge on probability, gain Knowledge on computation of probability with its practical and theoretical application in studying computer science.

Objective:

1. Understands the concept of random variable, moment generating function and their properties.
2. Learn Standard distributions in discrete and continuous cases.
3. Learn basics of probability, Baye„s theorem, stochastic process and Queuing theory.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Learn basics of probability, Bayes' theorem.
2. Describe the understanding of the concept of random variable, moment generating function and their properties.
3. Apply Standard distributions in discrete and continuous cases.
4. Apply stochastic process and Queuing theory.

Course Content:

Probability: Probability Models, Sample Space, Events, Algebra of Events, Probability Axioms, Conditional Probability, Multiplication Rule, Total Probability, Bayes‟ rule.

Random Variables: Discrete, Continuous and Mixed Random Variables, Probability Mass, Distribution and Cumulative Distribution Functions.

Probability Distributions: Discrete probability distributions -Binomial, Poisson, Negative Binominal Distributions and Their Properties Continuous probability distributions -Uniform, Normal, Exponential Distributions and their Properties. Stochastic process; Markov chains (discrete parameter, continuous parameter, birth-death process); Queuing models (birth-death model, Monrovian model), open and closed queuing network; Application of queuing models.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Learn basics of probability, Bayes' theorem.	√											
Describe the understanding of the concept of random variable, moment generating function and their properties.	√											
Apply Standard distributions in discrete and continuous cases.	√											
Apply stochastic process and Queuing theory.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Recurrence Problems: The Tower of Hanoi Lines in The Plane The Josephus Problem	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Sums: Manipulation of sums, Multiple Sums, General Methods, Finite and Infinite Calculus, Infinite Sums	
3	Lec 7 Lec 8 Lec 9	Number Theory: Divisibility, Primes, Prime Examples, Factorial Factors	
4	Lec 10 Lec 11 Lec 12	Number Theory: Relative Primarily, mod: The Congruence Relation, Independent Residues, Additional Applications, Phi and Mu	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Special Numbers: Stirling Numbers, Eulerian Numbers, Harmonic Numbers	
6	Lec 16 Lec 17 Lec 18	Special Numbers: Harmonic Summation, Bernoulli Numbers, Fibonacci Numbers	

7	Lec 19 Lec 20 Lec 21	Generating Functions	
8	Lec 22 Lec 23 Lec 24	Introduction to Probability: Probability Definition, Conditional Probability, Independent Probability, Bayes' Formula	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Discrete Random variables: The Bernoulli Random Variable, The Binomial Random Variable, The Geometric Random Variable, The Poisson Random Variable	
10	Lec 28 Lec 29 Lec 30	Continuous Random variables: The Uniform Random Variable, Exponential Random Variables, Gamma Random Variables, Normal Random Variables,	
11	Lec 31 Lec 32 Lec 33	Expectation of a Random Variable: The Discrete Case, The Continuous Case	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Review on Random Variable Stochastic Process: Definition with application	
13	Lec 37 Lec 38 Lec 39	Markov chains: Definition, Transforming a Process into a Markov Chain, Chapman–Kolmogorov Equations	
14	Lec 40 Lec 41 Lec 42	Queuing models Review	

Text and Ref Books:

1. Concrete Mathematics -BY Graham, Knuth, Patashnik, 2nd Edition.
2. Introduction to Probability Models BY Sheldon M. Ross, 9th Edition.
3. Introduction to Probability BY Dimitri P. Bertsekas and John N. Tsitsiklis

CSE-315 — 3 hours in a week, 3.00 Cr.

Digital System Design

Pre-requisite: CSE-305

Rationale:

This course deals with design of different components of basic computer and applying knowledge in the initial interfacing of basic computer.

Objective:

1. To provide a basic idea of the structure and interface of different components of Digital Computer Systems.
2. To design different components of basic computer
3. To understand and design microprocessor of basic computer.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Design different components of a microcomputer like Accumulator, Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory.
2. Design a fully customized microprocessor with special features.
3. Understand how to design a digital system using various methods.

Course Content:

Digital system design Hierarchy; ASM charts; Hardware description language; Design using MSI and LSI components; Combinational and sequential circuit design with PLA's, Design of memory subsystem using SRAM and DRAM; Design of various components of a computer: Accumulator design, Shifter design, ALU, memory and control unit - hardwired and micro-programmed, Microprocessor based designs; Computer bus standards; Design using special purpose controllers. Introduction to Simple As Possible (Microprocessor)- Architecture, Instruction Set, Design, Microprogramming, SAP-1, SAP-2, SAP-3 Introduction to Embedded Systems; Product design; Product development process.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Design different components of a microcomputer like Accumulator, Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory with presentation.	√											
Design a fully customized microprocessor with special features.	√											

Describe the understanding of how to design a digital system using various methods.		√										

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Digital system design Hierarchy; ASM charts; Hardware description language;	
2	Lec 4 Lec 5 Lec 6	Design using MSI and LSI components; Combinational and sequential circuit design with PLA's	**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Design of memory subsystem using SRAM and DRAM	
4	Lec 10 Lec 11 Lec 12	Design of various components of a computer: Accumulator design,	
5	Lec 13 Lec 14 Lec 15	Shifter design	**Class Test 2**
6	Lec 16 Lec 17 Lec 18	Design ALU, memory and control unit - hardwired and micro-programmed	
7	Lec 19 Lec 20 Lec 21	Microprocessor based designs	
8	Lec 22 Lec 23 Lec 24	Computer bus standards; Design using special purpose controllers.	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Introduction to Simple As Possible (Microprocessor)- Architecture, Instruction Set	
10	Lec 28 Lec 29 Lec 30	Simple As Possible-1: Design and Microprogramming	
11	Lec 31 Lec 32 Lec 33	Simple as Possible-2: Architecture, Instruction Set, Design and Microprogramming	
12	Lec 34 Lec 35 Lec 36	Simple as Possible-: Architecture, Instruction Set, Design and Microprogramming	**Class Test 4**
13	Lec 37 Lec 38 Lec 39	Introduction to Embedded Systems; Product design	
14	Lec 40 Lec 41 Lec 42	Product development process	

Text and Ref Books:

1. Digital Logic and Computer Design-M. Morris Manno
2. Digital Computer Architecture – Malvino, Brown
3. Digital Design and Computer Architecture - David Harris and Sarah Harris

CSE-316 1.50 hours in a week, 0.75 Cr.

Digital System Design Sessional

Pre-requisite: None

Rationale:

This course deals with design of different components of basic computer and fully customized microprocessor of basic computer.

Objective:

1. To design different components of basic computer
2. To understand and design microprocessor of basic computer.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Design different components of the microprocessor using the concept of computer system design.
2. Implement combinatorial and sequential system using simulation software.
3. Design and implement a customized microprocessor with special features and simulate it using simulation software with team presentation.

Course Content:

Design of various components of a computer: Accumulator design, Shifter design, ALU, memory and control unit - hardwired and micro-programmed, Design fully customized Simple As Possible (Microprocessor)- Architecture, Instruction Set, Control Unit.

Teaching-learning and Assessment Strategy:

Lectures, Class Performance, Project, Quiz, Viva

Assessment Methods & their Weights:

Category	Marks %
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Design different components of the microprocessor using the concept of computer system design.								√				
Implement combinatorial and sequential system using simulation software.											√	
Design and implement a customized microprocessor with special features and simulate it using simulation software with team presentation.									√			

Lecture Schedule

Week	Lecture	Topics
1	Lec 1	Discuss about Shifter Design
2	Lec 2	Shifter Design (Software Simulation)
3	Lec 3	Shifter Design (Hardware Implementation)
4	Lec 4	Discuss about ALU Design
5	Lec 5	ALU Design (Software Simulation)
6	Lec 6	ALU Design (Hardware Implementation)
7	Lec 7	Class Performance using
8	Lec 8	Discuss about fully customized Simple As Possible
9	Lec 9	Simple As Possible Design: Architecture and Control Unit
10	Lec 10	Simple As Possible software simulation
11	Lec 11	Simple As Possible Design(Hardware Implementation)-Update
12	Lec 12	Simple As Possible Design(Hardware Implementation Without Control Unit)

13	Lec 13	Simple As Possible Design(Hardware Implementation With Control Unit)
14	Lec 14	Quiz

Text and Ref Books:

1. Digital Logic and Computer Design-M. Morris Manno
2. Digital Computer Architecture – Malvino, Brown

CSE-319 3 hours in a week, 3.00 Cr.

Software Engineering

Pre-requisite: None

Rationale:

This course is designed to provide a general introduction to software engineering and design. It will introduce the important concepts such as software processes and agile methods, essential software development activities from initial software specification through to system evolution.

Objective:

After undergoing this course, students should be able to:

1. Understand the process of designing, building, and maintaining large scale software.
2. Learn to estimate time and cost.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe the process of designing.
2. Build and maintain large scale software.
3. Discuss the time-cost estimation and ethical values.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe the process of designing.	√											
Build and maintain large scale software.			√									
Discuss the time-cost estimation and ethical values.					√							

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Software engineering	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Professional SW development and SW Engg ethics	
3	Lec 7	Requirements Engineering	

	Lec 8 Lec 9		
4	Lec 10 Lec 11 Lec 12	Software Processes	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Agile view of Process / Agile software development	
6	Lec 16 Lec 17 Lec 18	System modeling	
7	Lec 19 Lec 20 Lec 21	Performing User interface design (Pres)	
8	Lec 22 Lec 23 Lec 24	Architectural Design	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Product Metrics (Pres)	
10	Lec 31 Lec 32 Lec 33	Design and Implementation	
11	Lec 28 Lec 29 Lec 30	Software Testing and Maintenance	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Dependability and Security	
13	Lec 37 Lec 38 Lec 39	Security Engineering	
14	Lec 40 Lec 41 Lec 42	Project planning and management	

Text and Ref Books:

1. Software Engineering BY Ian Sommerville
2. Software Engineering- a practitioner's Approach BY Roger S. Pressman
3. Software Engineering: Principles and Practice BY Hans van Vliet

CSE-360 **3 hours in a week, 1.50 Cr.**

Integrated Design Project/ Capstone Project - I

Pre-requisite: CSE-105, CSE-203, CSE-215, CSE-205, their corresponding Sessionals and CSE-220.

Rationale:

Culminating demonstration of skills and knowledge achieved to date to apply and solve real life problems solvable through computer technology.

Objective:

To apply technical knowledge and skills for further research and design of computer system at professional engineering scale.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Develop systems' requirement specification from top-level customer requirements.
2. Analyse and compare design alternatives, at the system and subsystem levels, and use measures of performance or other criteria to rank alternatives.
3. Plan and organize an engineering design project using tools such as Gantt charts to develop a work breakdown structure, develop a schedule including milestones, and estimate effort and costs incorporating the ethical, financial and environmental issues.
4. Develop a design concept and elaborate it through to a detailed design by decomposing a system concept into component subsystems, identifying the subsystem requirements and applicable standards, and defining interfaces between the subsystems.
5. Build prototypes of key subsystems.

Course Content:

<u>Knowledge Acquisition:</u>

Introduction and brief with software, Discussion and submission Project Proposal, Learning Version Control System: Github, Interface design, Database Connectivity: Sqlite, Json, Cloud, Firebase database, Google Api, Sensor.

Implementation:

Idea Submission, Objective, Methodology, Literature Review, High Level Design, Low Level Design, Evaluation and feedback, Design & Partial Implementation (Prototype/Demo).

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, rubrics on problem analysis, literature review and designing prototype.

Assessment Methods & their Weights:

Assessment Method	(100%)
Project	40
Quiz	20
Viva/Presentation	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Develop system requirements from top-level customer requirements.	√	√				√						
Analyse and compare design alternatives, at the system and subsystem levels, and use measures of performance or other criteria to rank alternatives.		√	√		√							
Plan and organize an engineering design project using tools such as Gantt charts to develop a work breakdown structure, develop a schedule including milestones, and estimate effort and costs.				√		√						
Develop a design concept and elaborate it through to a detailed design by decomposing a system concept into component subsystems, identifying the subsystem requirements and applicable standards, and defining interfaces between the subsystems			√	√								
Build prototypes of key subsystems.					√				√			

Lecture Schedule

Week	Topics	Remarks
1	Introduction and brief with softwares and Tools	
2	Learning Version Control System: Github	
3	Interface Design, activity and navication.	
4	Database Connectivity: Sqlite, Json, Cloud* Firebase database	
5	Google Api	
6	Sensor	
7	Database Integration with the application	
8-9	Topic Selection and Project Plan	
10-11	Objective, Methodology, Literature Review	
12-14	Design & Partial Implementation (Prototype/Demo)	

Text and Ref Books:

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

CSE-350 4 weeks, 1.00 Cr.

Industrial Training

This course is mandatory. Evaluation report from industry is to be submitted at the end of the training and accordingly to be incorporated in the tabulation sheet.

LEVEL-4 TERM-I

CSE-400 3 hours in a week, 1.5 Cr.

Thesis

Pre-requisite: None

Rationale:

This course motivates to go neck-deep in research, synthesize it, and make a point or look at something in a different way after going through all of it.

Objective:

To study, analyze and provide solutions for the problems of Computer Science and Engineering.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Select, analyze, and classify a particular field to do research.
2. Solve real life complex problems
3. Explain and describe the time-cost estimation and ethical values.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Select, analyze, and classify a particular field to do research.		√										
2. Solve real life complex problems.			√									
3. Explain and describe the time-cost estimation and ethical values.								√				

CSE-401 **3 hours in a week, 3.00 Cr.**

Information System Design and Development

Pre-requisite: None

Rationale:
This course motivates to perceive information systems planning, analysis, design and implementation; graphical methods for representing information structure, practical design methodologies, database design and prototyping; communication skills, project management to solve various real life problems.

Objective:
1. To assist students develop a comprehensive understanding of how information systems are developed through the activities of systems planning, analysis, design and implementation.
2. To analyze different information systems for different real life organizational context.
3. To understand the ethical and security considerations of an information system.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Discuss the practical approaches of designing & developing Information Systems for industries/ business organizations.
2. Discover and develop awareness of Information Technological ecosystems.
3. Solve real life complex problems.

Course Content:
Different types of information; Qualities of information; Analysis of Information requirements for modern organizations; Role, tasks and attributes of a Systems Analyst; Sources of information; Information gathering techniques; Editing; Handling of missing information; Requirements specifications; Steps of systems analysis; Concepts of feasibility analysis: Analysis of technical facilities; Cost-benefit analysis; Design of an information system; Design Patterns; Hardware and software analysis; Introduction to IT project management: Estimation of confidence level: Simplex method for minimization of project time; project team organization, ; IT Adoption and Diffusion theories; Ethics and privacy: Control and security.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss the practical approaches of designing & developing Information Systems for industries/ business organizations.			√									
2. Discover and develop awareness of Information Technological ecosystems.				√								
3. Solve real life complex problems.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Systems Concepts Types and Qualities of Information Information Systems Environment	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	The Systems Development Life Cycle Analysis of Information Information Requirements for Modern Organizations	
3	Lec 7 Lec 8 Lec 9	The Role of the Systems Analyst The Tasks of the Systems Analyst The Attributes of the Systems Analyst	
4	Lec 10 Lec 11 Lec 12	Systems Planning and the Initial Investigation Sources of information Information Gathering Techniques	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Requirements Analysis Requirement Specification Steps of Requirement Analysis	
6	Lec 16 Lec 17 Lec 18	Business Process Model Data Flow Diagrams Project Effort Analysis Methods	
7	Lec 19 Lec 20 Lec 21	The Tools of Structured Analysis Feasibility Analysis Analysis of Technical Facilities	
8	Lec 22 Lec 23 Lec 24	User Interface Design Interaction Design Information Architecture	
9	Lec 25 Lec 26	Design of an Information System Introduction to Project Management	

	Lec 27	Introduction to Project Management (Contd.)	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Project Time Management Estimation of Confidence Level Network Model for Project Time Estimation	
11	Lec 28 Lec 29 Lec 30	Productivity Tools Feasibility Analysis Analysis of Technical Facilities	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Cost/Benefit Analysis IT Adoption Diffusion Theory	
13	Lec 37 Lec 38 Lec 39	Project Risk Management Project Team Organization Estimation of confidence level	
14	Lec 40 Lec 41 Lec 42	Information System Security Ethics and Privacy Control and Security	

Text and Ref Books:

1. System Analysis and Design (2nd Edition) - Elias M. Awad; Galgotia Publications Pvt. Ltd. (2010)
2. System Analysis and Design (2nd Edition) - Raja Raman; Prentice Hall (2004)
3. System Analysis and Design Methods (7th Edition) - Jeffery L. Whitten; McGraw Hill (2007)
4. System Analysis and Design (9th Edition) - Kendel & Kendel; Pearson (2013)

CSE-402 **1.50 hours in a week, 0.75 Cr.**

Information System Design and Development Sessional

Pre-requisite: None

Rationale:
This course motivates to practically perceive information systems planning, analysis, design and implementation; graphical methods for representing information structure, practical design methodologies, database design and prototyping; communication skills, project management to solve various real life problems.

Objective:

1. To assist students develop a comprehensive understand practically of how information systems are developed through the activities of systems planning, analysis, design and implementation.
2. To analyze different information systems for different real life organizational context practically.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Design and implement Information Systems for industries/ business organizations.
2. Impose security levels to the projects of Information Technological ecosystems.
3. Solve real life complex problems.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Assessment Method	(100%)
Project	40
Quiz	20
Viva/Presentation	10
Class Participation	10
Home Assignment/Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Design and implement Information Systems for industries/ business organizations.									√			
Impose security levels to the projects of Information Technological ecosystems.											√	
Solve real life complex problems.							√					

Lecture Schedule

Week	Topics	Remarks
1-2	Introduction to Systems Concepts Project Proposal Approval	
3-4	System Analysis Requirement Specification	Report 1
5-6	Data Flow Diagrams	Report 2
7-8	Prototype Design	Report 3
9-10	Implementation	Project Update 1
11-12	Unit test and performance measure Enhancement of Design Implement	Report 4 Project Update 2
13-14	Final Project Submission Presentation Quiz	

Text and Ref Books:

1. System Analysis and Design (2nd Edition) - Elias M. Awad; Galgotia Publications Pvt. Ltd. (2010)
2. System Analysis and Design (2nd Edition) - Raja Raman; Prentice Hall (2004)

CSE-403 **3 hours in a week, 3.00 Cr.**

Artificial Intelligence

Pre-requisite: None

Rationale:
Artificial intelligence is the beginning of revolution for rational behavior of intelligent agents along with knowledge perception, representation, planning, reasoning, learning and understanding ideas to solve real life complex situations.

Objective:
1. To discuss and distinguish the notions of rational behavior and intelligent agents.
2. To develop a general appreciation of the goals, subareas, achievements and difficulties of AI.
3. To have knowledge of methods of blind as well as informed search in case of knowledge representation, planning, learning, robotics and other AI areas and ability to practically apply the corresponding techniques.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Discuss and distinguish the notions of rational behavior and intelligent agents.
2. Develop a general appreciation of the goals, subareas, achievements and difficulties of AI.
3. Analysis methods of blind as well as informed search and ability to practically apply the corresponding techniques.
4. Investigate of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Assessment Method	(100%)
Class Assessment	
Class Participation	05
Class Test	20
Mid Exam	15
Exam	
Final exam	60

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss and distinguish the notions of rational behavior and intelligent agents.	√											
2. Develop a general appreciation of the goals, subareas, achievements and difficulties of AI.			√									
3. Analysis methods of blind as well as informed search and ability to practically apply the corresponding techniques.		√										
4. Investigate of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to AI Agent Architecture Solving Problems by Searching	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Uninformed Search I Partial informed Search II	
3	Lec 7 Lec 8 Lec 9	Informed Search I Informed Search II	
4	Lec 10	Beyond Classical Search	**Class Test 2**

	Lec 11 Lec 12	Adversarial Search I	
5	Lec 13 Lec 14 Lec 15	Adversarial Search II Constraint Satisfaction Problems I	
6	Lec 16 Lec 17 Lec 18	Constraint Satisfaction Problems I Constraint Satisfaction Problems II	
7	Lec 19 Lec 20 Lec 21	Planning with State Space Search Planning with Partial Order Search Graph Search	
8	Lec 22 Lec 23 Lec 24	Uncertainty and Probabilities Propositional Logic First Oder Logic	
9	Lec 25 Lec 26 Lec 27	Second Oder Logic Markov Models (MM), Hidden MM (HMM)	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Bayesian Rule Probabilistic reasoning Bayes Net	
11	Lec 28 Lec 29 Lec 30	ML: Naive Bayes Belief Networks Decision Networks	
12	Lec 34 Lec 35 Lec 36	ML: Perceptions ML: Kernels and Clustering	
13	Lec 37 Lec 38 Lec 39	Advanced Applications: NLP, Games and Cars	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Advanced Applications: (Robotics and Computer Vision)	

Text and Ref Books:

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

CSE-404 **1.50 hours in a week, 0.75 Cr.**

Artificial Intelligence Sessional

Pre-requisite: None

Rationale:
Hands on orientation with AI programming, intelligent agents along with how to representation, planning, learning and perception of knowledge of agents.

Objective:

1. To have general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.
2. To develop programming skills for AI applications and explore traditional AI techniques and algorithms.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Have general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.
2. Develop programming skills for AI applications.
3. Exposure to traditional AI techniques and algorithms.

Course Contents:
Introduction to Intelligent Machines, State Mapping, A* Search implementation, Local search Algorithm, Advesrarial Search, Constrant Satisfaction Problem Solving.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, project, presentation, report.

Assessment Methods & their Weights:

Assessment Method	(100%)
Tasks	50
Quiz/Viva	10
Class Participation	10
Observation	10
Class performance	20

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Have general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.							√					
Develop programming skills for AI applications.								√				
Exposure to traditional AI techniques and algorithms.											√	

Lecture Schedule

Week	Lecture	Topics
1-2	Lec 1 Lec 2 Lec 3	Orientation with AI practical areas
3-4	Lec 4 Lec 5 Lec 6	Assignment on State Mapping
5-6	Lec 7 Lec 8 Lec 9	Assignment on Search Algorithm
7-8	Lec 10 Lec 11 Lec 12	Assignment on Local Search
9-10	Lec 13 Lec 14 Lec 15	Assignment on Adversarial Search
11-12	Lec 16 Lec 17 Lec 18	Assignment on Constraint Satisfaction Problem
13-14	Lec 19 Lec 20 Lec 21	Quiz/Viva

CSE-405 **3 hours in a week, 3.00 Cr.**

Computer Interfacing

Pre-requisite: None

Rationale:

This course introduces basic concepts and techniques for interfacing a microcontroller or microprocessor to external devices for data collection and process control and developing the related software required. It is aimed at students interested in data acquisition and real-time control systems, design and construct simple control, data logging system incorporating input/output to and from external devices and design simple control system for stepper and DC motor.

Objective:

1. To enable the students familiar to interface external components (peripherals, sensors, PPIs, PICs etc.) with computer systems.
2. To enhance the knowledge on basic working principle and different applications of basic microcomputer and microcontroller.
3. To enable the students capable of designing and constructing simple control system incorporating input/output to and from external devices.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe how to interface different types of external components (peripherals, sensors, PPIs, PICs etc.) with computer systems.
2. Escalate the capability of designing and constructing simple control system incorporating input/output to and from external devices.
3. Analyze the basic working principle of basic microcomputer, microcontroller and enhance applications of different hardware components.

Course Content:

I/0 system; I/O devices, designing I/O systems; Programmable peripheral interface (interface to A/D and D/A converter); keyboard/display interface; Programmable timer; data acquisition systems, Optical interrupters and couplers, incremental encoders, interfacing; Programmable interrupt controller, DMA controller; floppy and hard-disk controller; serial communication interface; ISA. PCI, AGP, PS/2 and USB interface; Interfacing with power circuits, stepper motors, opto-isolation; controlling semiconductor power switches MOSFET, BJT. SCR. Triac and Solenoids; temperature, pressure, light sensors and transducers; Application of Opto-coupler and relays; Embedded Communication Systems, Embedded Computer Security.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Describe how to interface different types of external components (peripherals, sensors, PPIs, PICs etc.) with computer systems	√											
2. Escalate the capability of designing and constructing simple control system incorporating input/output to and from external devices			√									
3. Analyze the basic working principle of basic microcomputer, microcontroller and enhance applications of different hardware components		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Parallel data transfer, parallel printer interface, Keyboard Interface, Display Interface,I/0 system; I/O devices, designing I/O systems	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Interfacing to high power devices, Interface to AC power devices, interfacing to stepper motor	
3	Lec 7 Lec 8 Lec 9	D/A Applications and Interfacing to Microcomputers, A/D converters Specifications/types,	
4	Lec 10 Lec 11 Lec 12	Microcomputers based Scale, Microcomputers based industrial Process Control System , PID Controller	**Class Test 2**

5	Lec 13 Lec 14 Lec 15	Triac and Solenoids; temperature, pressure, light sensors and transducers	
6	Lec 16 Lec 17 Lec 18	D/A Converter Operation and Specifications, ISA. PCI, AGP, PS/2 and USB interface	
7	Lec 19 Lec 20 Lec 21	Embedded Communication Systems, Embedded Computer Security	
8	Lec 22 Lec 23 Lec 24	Data Highways, Computer I/O Operations, Programmed I/O, Interrupts, Vectored Interrupt, Priority Interrupts using Priority Encoder ,Priority Interrupt using a Daisy Chain	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Block Data Transfer, DMA, Parallel Interface, SCSI, Serial Interface-Synchronous and Asynchronous Transmission	
10	Lec 31 Lec 32 Lec 33	DMA Controller 8257,RS232, null modem connection, line drivers, Single-ended Transmission, balanced transmission, differential receiver	
11	Lec 28 Lec 29 Lec 30	Disc and tape storage, Recording on a Magnetic surface, Magnetic Disc Formats, zoning, Interleaving, Magnetic recording Code, Recording Codes, Run-length limited (RLL),	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Disc formatting, Track seeking, Sector Location, Optical Storage, Forms of Optical Disc storage, Optical Reading Mechanism	
13	Lec 37 Lec 38 Lec 39	CD-ROM Optical Disks, WORM, Optical Positioning, Magneto Optical Disk, Performance Enhancers	
14	Lec 40 Lec 41 Lec 42	Memory Interfacing, Memory Space Management	

Text and Ref Books:

1. The Intel Microprocessors (8th Edition) - Barry B Brey; Pearson (2008)
2. Microprocessors and Interfacing (2nd Edition) - Douglas V Hall; McGraw Hill (2005)
3. Computer Peripherals (3rd Edition) - Cook and White; Butterworth-Heinemann (1995)

CSE-460 **6 hours in a week, 3.00 Cr.**

Integrated Design Project/ Capstone Project - II

Pre-requisite: CSE-360

Rationale:

Culminating demonstration of skills and knowledge achieved to date to apply and solve real life IT dependent problems using computer technology.

Objective:

Objective of this course is to combine engineering theory with rigorous research in design and development of computerized system considering the contextual ethical, financial and environmental issues.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Design appropriate tests to measure and evaluate the performance of prototype subsystems to determine whether they meet performance and interface requirements considering ethical, financial and environmental issues and recommend changes.
2. Constructively contribute to the accomplishments of a multidisciplinary team, including critical evaluation of self and team-member performance.
3. Communicate the team's logistical and technical approaches to the design project in a polished, co-authored, written proposal, using language and graphics appropriate to the technical discipline.
4. Succinctly report individual and team performance against the plan.
5. Describe organizational and technical plans and progress in oral presentations, using high-quality, informative, graphical and textual elements.

Course Content:

Knowledge Acquisition: Information gathering techniques, Design of an information system; Hardware components, pin configurations of microcontroller, peripherals, Sensors, PPIs, PICs, Use of Arduino, Raspberry Pi;

Implementation: Concept development, prototype enhancement, complete implementation, unit testing and integration testing with verification, feedback and improvement, result analysis and performance evaluation, report writing, paper submission, presentation and final evaluation.

Teaching-learning and Assessment Strategy:

Lectures, performances, assignments, rubrics on prototype design, implementation and report submission.

Assessment Methods & their Weights:

Assessment Method	**(100%)**
Project	40
Quiz	20
Viva/Presentation	10
Class Participation	10
Home Assignment /Report	10
Class performance/observation	10

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Design appropriate tests to measure and evaluate the performance of prototype subsystems to determine whether they meet performance and interface requirements considering ethical, financial and environmental issues and recommend changes.			√				√	√				
Constructively contribute to the accomplishments of a multidisciplinary team, including critical evaluation of self and team-member performance.									√	√	√	
Communicate the team's logistical and technical approaches to the design project in a polished, co-authored, written proposal, using language and graphics appropriate to the technical discipline.										√		√
Succinctly report individual and team performance against the plan.										√		
Describe organizational and technical plans and progress in oral presentations, using high-quality, informative, graphical and textual elements.											√	√

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1-2	Orientation Information gathering techniques	
2	Lec 3-4	Approval of Conceptual development of proposed project Hands on session on designing information system	Project Plan
3	Lec 5-6	Hands on session on hardware components and microcontroller Designing Prototype	Prototype Design
4	Lec 7-8	Hand on session on Arduino, Programming on Arduino	
5	Lec 9-10	Hand on session Raspberry Pi Programming on Raspberry Pi	
6	Lec 11-12	Flowchart and block diagram of the project Prototype enhancement	Prototype Design
7	Lec 13-14	Unit testing and integration testing with verification Submission of abstract of paper/report	Implementation Report
8	Lec 15-16	Feedback and improvement Submission of introduction, methodology of paper/report	Implementation Report
9	Lec 17-18	Result analysis and performance evaluation Integration of result analysis in report	Implementation Report
10	Lec 19-20	Model of the project	
11	Lec 21-22	System architecture of the paper	Report
12	Lec 23-24	Project update following final timeline	
13	Lec 25-26	Implementation part of the paper Draft of poster presentation	
14	Lec 27-28	Final Project submission Final paper/report submission Final poster print and presentation	Report

HUM-415 **2 hours in a week, 2.00 Cr.**

Financial and Managerial Accounting

Pre-requisite: None

Rationale:

This course introduces the preliminaries of accounting principles, cost classification and a variety of financial analysis - ratio analysis, capital budgeting, break-even analysis, cost-volume-profit analysis, contribution margin analysis etc. that is helpful for making important decisions of the management control system of any organization or business.

Objective:

1. To discuss the fundamentals of accounting, the use and effects of financial statement for a particular organization.
2. To analyze different types of cost and cost management for different components of a management control system or a business.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss, describe and interpret a financial accounting statement and the use of financial ratios. The student should be able to understand how the reporting might be affected by a particular (creative) business.
2. Enhance the various elements of a management control system (role, scope, drawbacks, implementation etc.).
3. Determine the variety of cost concepts to be applied in a management control system.
4. Select and analyze the nature of a business and outline main features of an appropriate control system.

Course Content:

Financial Accounting: Objectives and importance of accounting; Accounting as an information system. Computerized system applications in accounting. Recording system, double entry mechanism; account and their classification; Accounting equation: Accounting cycle: Journal, ledger, trial balance. Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions. Financial statement analysis and interpretation: Ratio analysis. Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost: Overhead recover method/rate; Job order costing: preparation of job cost sheet and question price, Inventory valuation: absorption costing and marginal/variable costing technique; Cost-Volume-Profit analysis: meaning, break-even analysis, contribution margin analysis sensitivity analysis. Short-term investment decisions; relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of investments.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss, describe and interpret a financial accounting statement and the use of financial ratios. The student should be able to understand how the reporting might be affected by a particular (creative) business.	√											
2. Enhance the various elements of a management control system (role, scope, drawbacks, implementation etc.).				√								
3. Determine the variety of cost concepts to be applied in a management control system.				√								
4. Select and analyze the nature of a business and outline main features of an appropriate control system.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Financial Accounting Objectives of Accounting Importance of Accounting	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Accounting as an Information System. Computerized Applications in Accounting Computerized Applications in Accounting (Contd.)	
3	Lec 7 Lec 8 Lec 9	Recording System Double Entry Mechanism Double Entry Mechanism (Contd.)	
4	Lec 10 Lec 11 Lec 12	Account Classification Accounting Equation Account Cycle	**Class Test 2**
5	Lec 13	Journal	

	Lec 14 Lec 15	Ledger Trial Balance	
6	Lec 16 Lec 17 Lec 18	Financial Statement Preparation Adjusting Entries Closing Entries	
7	Lec 19 Lec 20 Lec 21	Accounting Principles Accounting Convention Accounting Convention (Contd.)	
8	Lec 22 Lec 23 Lec 24	Financial Statement Analysis Financial Statement Interpretation Ratio Analysis	
9	Lec 25 Lec 26 Lec 27	Cost Accounting Management Accounting Cost Concept and Classification	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Distribution of Overhead Cost Overhead Recover Method/Rate Job Order Costing	
11	Lec 28 Lec 29 Lec 30	Preparation of Job Cost Sheet and Question Price Inventory Valuation Absorption Costing	
12	Lec 34 Lec 35 Lec 36	Marginal/Variable costing Technique Cost-Volume-Profit Analysis Break-Even Analysis	
13	Lec 37 Lec 38 Lec 39	Contribution Margin Analysis Sensitivity Analysis. Relevant and Differential Cost Analysis	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Long-term Investment Decisions Capital Budgeting Various Techniques of Evaluation of Investments	

Text and Ref Books:

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

CSE-4XO **3 hours in a week, 3.00 Cr.**

Option-II

LEVEL-4 TERM-II

CSE-400 **6 hours in a week, 3.00 Cr.**

Thesis

Pre-requisite: None

Rationale:

This course motivates to go neck-deep in research, synthesize it, and make a point or look at something in a different way after going through all of it.

Objective:

To study, analyze and provide solutions for the problems of Computer Science and Engineering.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Select, analyze and classify a particular field to do research.
2. Solve real life complex problems
3. Explain and describe the time-cost estimation and ethical values.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Select, analyze and classify a particular field to do research.		√										
2. Solve real life complex problems.			√									
3. Explain and describe the time-cost estimation and ethical values.								√				

CSE-413 **3 hours in a week, 3.00 Cr.**

Computer Graphics

Pre-requisite: None

Rationale:
This course motivates to enhance the ability in order to rapidly visualize, design and modify different types of shapes, structures and images interactively that is absolutely mandatory in the field of engineering and imaging technology.

Objective:
1. To provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. To introduce computer graphics techniques, focusing on 3D modeling, image synthesis, and rendering.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Discuss the algorithmic and mathematical tools used to create a variety of digital images and effects.
2. Demonstrate three main subjects within computer graphics, modeling, rendering, and animation.
3. Select and analyze fundamentals such as digital image representation, color perception, image formation and image processing.

Course Content :

Introduction to computer graphics and its applications; Principles of raster image generation; Light and Color models; Example of a graphics API; Graphics primitives; Graphics hardware; Graphics pipeline; Coordinate convention; Scan conversion; Clipping; Modeling transformations; Viewing transformations; Projection transformations; Polygons and polygon meshes; Curves and surfaces; Hidden lines and surface removal; Introduction to rendering including shading models, textures, ray tracing, and radiosity; Introduction to computer animation and kinematics; Fractals; Graphics programming using OpenGL 4.0 and above.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss the algorithmic and mathematical tools used to create a variety of digital images and effects.	√											
2. Demonstrate three main subjects within computer graphics, modeling, rendering, and animation.				√								
3. Select and analyze fundamentals such as digital image representation, color perception, image formation and image processing.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Computer Graphics Applications of Computer graphics Standard Graphics Primitives	
2	Lec 4 Lec 5 Lec 6	Principles of Raster Image Generation Graphics Hardware Graphics Pipeline	
3	Lec 7 Lec 8 Lec 9	Coordinate Convention Scan Convention Example of a Graphics API	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Introduction to OpenGL Graphics Programming Graphics Programming (Contd.)	
5	Lec 13 Lec 14 Lec 15	Point Clipping Line Clipping Polygon Clipping	
6	Lec 16 Lec 17 Lec 18	Modeling Transformations Modeling Transformations (Contd.) Modeling Transformations (Contd.)	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Viewing Transformations Viewing Transformations (Contd.) Viewing Transformations (Contd.)	
8	Lec 22 Lec 23 Lec 24	Projection Transformations Projection Transformations (Contd.) Projection Transformations (Contd.)	
9	Lec 25 Lec 26 Lec 27	Polygons Polygons (Contd.) Polygon Meshes	**Class Test 3**
10	Lec 31 Lec 32	Curves Surfaces	

	Lec 33	Surfaces (Contd.)	
11	Lec 28 Lec 29 Lec 30	Introduction to Shading Models Rendering Hidden Lines and Surface Removal	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Introduction to Computer Animation Kinematics Fractals	
13	Lec 37 Lec 38 Lec 39	Textures Ray Tracing Radiosity	
14	Lec 40 Lec 41 Lec 42	Color Perception Color Models Light Models	

Text and Ref Books:

1. Theory and Problems of Computer Graphics (3rd Edition) – Zhigang Xiang, Roy A. Plastock; McGraw Hill (2000)
2. Computer Graphics C Version (3rd Edition) – Donald Hearn, M. Pauline Baker; Pearson Prentice Hall (2004)
3. Computer Graphics Principle and Practice (3rd Edition) – Donald Hearn, M. Pauline Baker; Addison-Wesley Professional (2013)

CSE-414 — 1.50 hours in week, 0.75 Cr.

Computer Graphics Sessional

Pre-requisite: None

Rationale:

This course motivates to develop and modify 2D and 3D visualization and transformation of any geometric object by using graphics library as well as working with texturing, lighting and coloring of such objects to develop different types of digital images with various effects.

Objective:

1. To develop 2D, 3D and animation graphics project using OpenGL graphics library.
2. To develop projects using lighting, coloring and texturing techniques.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Achieve a basic idea about OpenGL graphics library.
2. Design and develop 2D and 3D graphical geometric objects using OpenGL.
3. Learning simple animation, lighting, coloring and texturing.

Course Content :

Introduction to OpenGL, Drawing 2D geometric object, Simple 2D animation and modeling transformation, Drawing 3D geometric object, Viewing transformation and Texturing and lighting.

Teaching-learning and Assessment Strategy:

Lectures, class performances, project, assignment, viva, presentation, quiz.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Achieve a basic idea about OpenGL graphics library.							√					
2. Design and develop 2D and 3D graphical geometric objects using OpenGL.						√						
3. Learning simple animation, lighting, coloring and texturing.									√			

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1	Lec 1 Lec 2 Lec 3	Introduction to OpenGL (GLSL) Discussion on Project 1 Discussion on Project 1 (Contd.)	
2	Lec 4 Lec 5 Lec 6	Programming with OpenGL (GLSL) Lab Assignment Home Assignment	

3	Lec 7 Lec 8 Lec 9	Programming with OpenGL (GLSL) (Contd.) Lab Assignment Home Assignment	
4	Lec 10 Lec 11 Lec 12	Introduction to Animation (with Blender) Animation Project Discussion Animation Project Discussion (Contd.)	
5	Lec 13 Lec 14 Lec 15	Project 1 Demo and Submission Project 1 Demo and Submission (Contd.) Project 1 Demo and Submission (Contd.)	
6	Lec 16 Lec 17 Lec 18	Discussion on Project 2 Discussion on Project 2 (Contd.) Discussion on Project 2 (Contd.)	
7	Lec 19 Lec 20 Lec 21	Discussion on Project 2 Discussion on Project 2 (Contd.) Discussion on Project 2 (Contd.)	
8	Lec 22 Lec 23 Lec 24	Animation Project Submission Animation Project Submission (Contd.) Report Submission	
9	Lec 25 Lec 26 Lec 27	Animation Project Submission Animation Project Submission (Contd.) Report Submission	
10	Lec 31 Lec 32 Lec 33	Project 2 Initial Demo Project 2 Initial Demo (Contd.) Project 2 Initial Demo (Contd.)	
11	Lec 28 Lec 29 Lec 30	Project 2 Initial Demo Project 2 Initial Demo (Contd.) Project 2 Initial Demo (Contd.)	
12	Lec 34 Lec 35 Lec 36	Project 2 Final Demo and Submission Project 2 Final Demo and Submission (Contd.) Project 2 Final Demo and Submission (Contd.)	
13	Lec 37 Lec 38 Lec 39	Project 2 Final Demo and Submission Project 2 Final Demo and Submission (Contd.) Project 2 Final Demo and Submission (Contd.)	
14	Lec 40 Lec 41 Lec 42	Quiz Viva Viva (Contd.)	

Text and Ref Books:

1. OpenGL Programming Guide: The Official Guide to Learning OpenGL (8th Edition) - Dave Shreiner, Graham Sellers, John Kessenich and Bill Licea-Kane; Addison Wesley Professional (2013)

CSE-415 **3.00 hours in a week, 3.00 Cr.**

Human Computer Interaction

Pre-requisite: None

Rationale:

Motivates to enrich socio-technological discipline to bring the power of computers and communications systems to people in ways and forms that are both accessible interactively and useful in our working, learning, communicating, and recreational lives.

Objective:

1. To specify fundamental human and computational abilities and constraints and design requirements accordingly by using suitable HCI techniques.
2. To evaluate the quality of a user interface using various methods to design a usable and useful interface.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe the basics of human and computational abilities and limitations.
2. Discuss basic theories, tools and techniques in HCI.
3. Compare, classify and explain the fundamental aspects of designing and evaluating interfaces.
4. Practice a variety of simple methods for evaluating the quality of a user interface.

Course Content:

Introduction to Human-Computer Interaction. Task-centered system design: User-centered design and prototyping: methods for involving the user, prototyping, low and medium fidelity. prototypes, Wizard of Oz examples. Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method. Psychology of everyday things: psychopathology of everyday things, examples, concepts for designing everyday things. Beyond screen design: characteristics of good representations, information visualization, Tufte’s guidelines, visual variables, metaphors, direct manipulation. Graphical screen design: graphical design concepts, components of visible language, graphical design by grids. Design principles and usability heuristics: design principles, principles to support usability, golden rules and heuristics, HCI patterns. Semiotic in HCI. HCI design standards: process-oriented standards, product oriented standards, strengths and limitations of HCI Standards. Past and future of HCI: the past, present and future, perceptual interfaces, context-awareness and perception.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Understand the basics of human and computational abilities and limitations.	√											
2. Evaluate the design requirement of various engineering machines.					√							
3. Analyze the fundamental aspects of designing and evaluating interfaces.		√										
4. Practice a variety of simple methods for evaluating the quality of a user interface.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Human-Computer Interaction Applications of HCI Task-Centered System Design	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	User-centered Design and Prototyping Low and Medium Fidelity Prototypes Goals and Approaches of Evaluation	
3	Lec 7 Lec 8 Lec 9	Methods for Evaluation of Interfaces with Users Methods for Evaluation of Interfaces with Users (Contd.) Introspection	
4	Lec 10 Lec 11 Lec 12	Interviews and Questionnaires Continuous Evaluation User Feedback and Field Studies	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Extracting the conceptual model Direct Observation Constructive Interaction	
6	Lec 16 Lec 17 Lec 18	Ethics of evaluation Ethics of evaluation (contd.) Choosing an Evaluation Method	
7	Lec 19	Psychology of Everyday Things	

	Lec 20 Lec 21	Concepts for Designing Everyday Things Concepts for Designing Everyday Things (Contd.)	
8	Lec 22 Lec 23 Lec 24	Characteristics of Good Representations Information Visualization Tufte's Guidelines	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Visual Variables Metaphors Direct Manipulation	
10	Lec 31 Lec 32 Lec 33	Graphical Design Concepts Components of Visible Language Graphical Design by Grids	
11	Lec 28 Lec 29 Lec 30	HCI Patterns Semiotic in HCI Semiotic in HCI (Contd.)	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Design Principles Usability Heuristics Golden Rules and Heuristics	
13	Lec 37 Lec 38 Lec 39	Process-Oriented Standards Product Oriented Standards Strengths and Limitations of HCI Standards	
14	Lec 40 Lec 41 Lec 42	Past and Future of HCI Perceptual Interfaces Context-Awareness and Perception	

Text and Ref Books:

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

CSE-416 — 1.50 hours in a week, 0.75 Cr.

Human Computer Interaction Sessional

Pre-requisite: None

Rationale:

Motivates to enrich socio-technological discipline to bring the power of computers and communications systems to people in ways and forms that are both accessible interactively and useful in our working, learning, communicating, and recreational lives.

Objective:

1. To specify fundamental human and computational abilities and constraints and design requirements accordingly by using suitable HCI techniques.
2. To design and evaluate the quality of a user interface using various methods to design a usable and useful interface.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discover and apply theoretical knowledge and develop projects considering the criteria of HCI and meeting the principle.
2. Estimate and evaluate how developed systems (UI and Action) are violating different Heuristics of HCI.
3. Select and analyze the fundamental aspects of designing and evaluating interfaces.

Course Content:

Introduction to Human-Computer Interaction, Task-centered system design, Design principles, graphical design by grids, design concepts, Prototype, IDM, Semiotic in HCI.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Discover and apply theoretical knowledge and develop projects considering the criteria of HCI and meeting the principle.							√					
Estimate and evaluate how developed systems (UI and Action) are violating different Heuristics of HCI.										√		
Select and analyze the fundamental aspects of designing and evaluating interfaces.							√					

Lecture Schedule

Week	Topics	Remarks
1-2	Introduction with HCI labs Design principles	
3-4	Project Idea Approval	
5-6	Prototype Practical Session on Card Sorting Project Update 1	
7-8	IDM Hands on practice on IDM	
9-10	Prototyping Project Update 2	
11-12	Design and Development using IDM	
13-14	Final Project Submission and Presentation	

Text and Ref Books:

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

CSE-429 **3 hours in a week, 3.00 Cr.**

Computer Security

Pre-requisite: None

Rationale:
This course motivates to gather brief review of computer crimes and causes, Internet, strategies, crime prevention, security.

Objective:

1. To understand the development of security, traditional encryption, security attacks and the fundamental security objectives
2. To determine and analyze the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:

1. Understand the development of security, traditional encryption, security attacks and the fundamental security objectives
2. Determine the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases.
3. Analyze the design and implementation issues of a real-life security solution.

Course Contents:
Overview, Symmetric cipher, Classical encryption technique, Block cipher and the data encryption standard (DES), Triple DES, Introduction to finite fields, Advanced Encryption Standard, Contemporary Symmetric Ciphers, confidentiality using symmetric encryption public, Key encryption and Hash functions, Public-key Cryptography, RSA algorithm, Key management, Diffie-Hellman key exchange, Other Public Key Cryptosystem, Message Authentication and Hash function, Hash Algorithm, Digital Signatures and Authentication protocols, Network Security practice, Authentication application, Wireless Network Security, Electrical Mail security, IP security, Web security, System security, Intruders, Malicious software and Firewall, Legal and Ethical Aspects.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Understand the development of security, traditional encryption, security attacks and the fundamental security objectives	√											
Determine the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases.		√										
Analyze the design and implementation issues of a real-life security solution.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction Symmetric cipher	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Classical encryption technique Block cipher	
3	Lec 7 Lec 8 Lec 9	Data Encryption Standard (DES) Triple DES	
4	Lec 10 Lec 11 Lec 12	Introduction to finite fields Advanced Encryption Standard	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Contemporary Symmetric Ciphers Symmetric Encryption	
6	Lec 16 Lec 17 Lec 18	Key Encryption Hash Functions	
7	Lec 19 Lec 20 Lec 21	Public-key Cryptography RSA Algorithm Key Management	
8	Lec 22 Lec 23 Lec 24	Diffie-Hellman key exchange Public Key Cryptosystem	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Message Authentication and Hash function Hash Algorithm	

10	Lec 31 Lec 32 Lec 33	Digital Signatures Authentication protocols	
11	Lec 28 Lec 29 Lec 30	Network Security practice Authentication application Wireless	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Network Security Electrical Mail security IP security	
13	Lec 37 Lec 38 Lec 39	Web security System security Intruders	
14	Lec 40 Lec 41 Lec 42	Malicious software and Firewall Legal and Ethical Aspects.	

Text and Ref Books:

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

HUM-417 **3 hours in a week, 3.00 Cr.**

Engineering Management and Ethics

Pre-requisite: None

Rationale:
This course motivates engineers to perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct and manage the resources and decisions effectively. It elevates the profession and raises future standards and imprints on individual moral mindsets and behaviors.

Objective:
1. To identify and analyze practical legal problems commonly encountered in computing industry and formulate solutions to some of the legal problems.
2. To gain the ability to continue professional development with an understanding of the legal issues, and to critically assess the codes of professional conduct for computer professional.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Demonstrate awareness of different management and control frameworks and their impact on the Project Management discipline.
2. Solve and apply cognitive skills and ability to identify, analysis, and articulate the importance of team building, project risk, and time cost management.
3. Using management software to help plan and manage information technology projects.
4. Explain the theoretical aspects of ‘ethics’, ‘social norms’, ‘virtues’, ‘values’, ‘legal bindings in professional fields’ etc.

Course Content:
Engineering Management: Principles of management, Introduction to Project Management;, Project Integration Management; Project Scope Management; Project Time Management; Project Cost Management; Project Quality Management; Project Human Resource Management; Project Risk Management; MIS: Introduction, Decision Support Systems, MIS in decision making. Concept of Invention, Innovation, and Entrepreneurship.

Engineering Ethics: Introduction to Ethics. Theories of Ethics. Principles of Engineering Ethics. Ethical expectation: Employers and employees, inter-professional relationship, Standards and codes: Fundamental Canons, NSPE codes, IEEE codes of conduct, ACM codes; Institutionalization of ethical conduct. Ethical Dilemmas, Choices (Whistle Blowing), Computer Ethics: Computer Crime and Cyber Security, Privacy and Confidentiality issue in CSE, Legal Framework in CSE-Copyright laws, ICT Act, Right To Information (RTI), Patents, Royalty etc. Ethical Challenges for CSE Engineers with the advancement of Technology; Case studies related to ethical issues in ICT and other Engineering disciplines.

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Demonstrate awareness of different management and control frameworks and their impact on the Project Management discipline.				√								
2. Solve and apply cognitive skills and ability to identify, analysis, and articulate the importance of team building, project risk, and time cost management.		√										
3. Using management software to help plan and manage information technology projects.					√							
4. Explain the theoretical aspects of 'ethics', 'social norms', 'virtues', 'values', 'legal bindings in professional fields' etc.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1	Introduction to Engineering Management	**Class Test 1**
	Lec 2	Importance of Engineering Management (Contd.)	
	Lec 3	Importance of Engineering Management	
2	Lec 4	Principles of Management	
	Lec 5	Introduction to Project Management	
	Lec 6	Introduction to Project Management (Contd.)	
3	Lec 7	Project Integration Management	
	Lec 8	Project Scope Management	
	Lec 9	Project Time Management	
4	Lec 10	Project Cost Management	**Class Test 2**
	Lec 11	Project Quality Management	
	Lec 12	Project Human Resource Management	
5	Lec 13	Project Communication Management	

	Lec 14 Lec 15	Project Risk Management Project Procurement Management	
6	Lec 16 Lec 17 Lec 18	Introduction to MIS Decision Support System MIS in Decision Making	
7	Lec 19 Lec 20 Lec 21	Development of Communication Skill Concept of Invention and Innovation Concept of Entrepreneurship	
8	Lec 22 Lec 23 Lec 24	Introduction to Ethics Theories of Ethics Principles of Engineering Ethics	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Ethical expectation Employers and Employees Relationship Obligation of an Engineer to Clients	
10	Lec 31 Lec 32 Lec 33	Professional Organization: IEEE, ACM Standards and Codes Institutionalization of Ethical Conduct	
11	Lec 28 Lec 29 Lec 30	Ethical Dilemmas Choices (Whistle Blowing)	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Computer Crime and Cyber Security Privacy and Confidentiality Issue in CSE Legal Framework in CSE-CopyRight laws	
13	Lec 37 Lec 38 Lec 39	ICT Act Right To Information (RTI) Patents and Royalty	
14	Lec 40 Lec 41 Lec 42	Ethical Challenges for CSE Engineers Case Studies Regarding Ethical Issues in ICT Case Studies Regarding Ethical Issues in ICT	

Text and Ref Books:

1. Engineering Ethics Concepts and Cases (2nd Edition) - Charles E. Harris. Jr. , Michael S. Pritchard , Michael J. Rabins; Wadsworth Cengage Learning (2009)
2. Introduction to Engineering Ethics (3rd Edition) - Schinzinger and Martin; McGraw Hill (2000)

CSE-4XO **3 hours in a week, 3.00 Cr.**

Option-III

CSE-4XE **1.50 hours in a week, 0.75 Cr.**

Option-III Sessional

Option-I

HUM- 237 Engineering Economics
2 hours in a week, 2.00 Cr.

Pre-requisite: None

Rationale:
To be able to analyze and select the most economical alternative among several design alternatives.

Objective:

1. To understand time-value of money concepts and the criteria for making economic-based decisions.
2. To analyze before-tax and after-tax cash flows.
3. To understand economic risk analysis techniques.
4. To conduct minimum life cycle cost tradeoffs between initial and repair costs.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Explain time-value of money concepts and the criteria for making economic-based decisions.
2. Evaluate the design requirement of various engineering machines.
3. Interpret the economic risk of analysis techniques.
4. Illustrate minimum life cycle cost tradeoffs between initial and repair costs.
5. Apply Deduce before-tax and after-tax cash flows.

Course Content:
Microeconomics: Definition of economics; Fundamentals of economics; Market and government in a modern economy; Basic elements of supply and demand; Choice and utility; indifference curve technique; Analysis of cost; Short run long run theory of production. Macroeconomics: Key concept of macroeconomics; Saving, consumption, investment; National income analysis; Inflation, Unemployment. Development: Theories of developments; Banking system of Bangladesh, National Budget, Development partners(World Bank, Asian Development Bank, World Trade Organization, International Monetary Fund)

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain time-value of money concepts and the criteria for making economic-based decisions.	√											

Deduce before-tax and after-tax cash flows.			√									
Interpret the economic risk of analysis techniques.				√								
Illustrate minimum life cycle cost tradeoffs between initial and repair costs.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2	Definition of economics	
2	Lec 3 Lec 4	Fundamentals of economics	
3	Lec 5 Lec 6	Market and government in a modern economy	**Class Test 1**
4	Lec 7 Lec 8	Basic elements of supply and demand	
5	Lec 9 Lec 10	Choice and utility; indifference curve technique	
6	Lec 11 Lec 12	Analysis of cost	**Class Test 2**
7	Lec 13 Lec 14	Short run long run theory of production	
8	Lec 15 Lec 16	Macroeconomics: Key concept of macroeconomics	
9	Lec 17 Lec 18	Saving, consumption, investment	
10	Lec 19 Lec 20	National income analysis	**Class Test 3**
11	Lec 21 Lec 22	Inflation, Unemployment. Development	
12	Lec 23 Lec 24	Theories of developments	
13	Lec 25 Lec 26	Banking system of Bangladesh	**Class Test 4**
14	Lec 27 Lec 28	National Budget, Development partners	

Text and Ref Books:

1. Economic (19th ed) – Samuelson (2009)
2. Economic (9th ed) – John Sloman (2012)
3. Economic Development (12th ed) – Michael Todaro (2015)
4. Money and Banking (2nd ed) – Dudly g luckett (1976)

HUM- 241 **2 hours in a week, 2.00 Cr.**

Bangladesh Studies

Pre-requisite: None

Rationale:

This course has been designed to help the students in obtaining comprehensive idea about the history, culture and heritage of Bangladesh. It will introduce students with economy, society, politics, diplomacy and foreign policy of Bangladesh. Students will learn about the challenges and potentials of Bangladesh in shaping its peaceful and sustainable future. It will also assist the students in assessing roles and contribution of Bangladesh in the regional and international bodies which are dedicated to establish world peace.

Objective:

1. Introduce students with rich history, culture and heritage of Bangladesh.
2. Providing them in-depth knowledge on the major political events that shaped Bangladesh as an independent sovereign state.
3. Improve their understanding on political, economic and social development of Bangladesh.
4. Help them think critically and comprehensively about foreign policy of Bangladesh, its relationship with other countries and its important roles in the international organizations like UN, Commonwealth and SAARC etc.

Course Outcomes (CO):

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

1. To enrich knowledge with brief history, culture and heritage of Bangladesh.
2. To provie in-depth knowledge on the major political events that shaped Bangladesh as an independent sovereign state.
3. To improve understanding on political, economic and social development of Bangladesh.
4. To think critically and comprehensively about foreign policy of Bangladesh, its relationship with other countries and its important roles in the international organizations like UN, Commonwealth and SAARC etc.

Course Content:

Ancient period and muslim period of bengal, British period, pakistan period: an overview (1952-1971), The problem of national integration under ayub regime, Elite in crisis during pakistan rule, nation-building in the new state, The ideals and philosophy of constitution-making of Bangladesh, Study on the coup and assassination of mujib, Philosophy and fundamental changes of zia regime, Constitutional amendments of Bangladesh, Corruption and good governance in Bangladesh, Issues of governance of bangladesh, bangladesh economy, Ideas on political and ethnic conflict in Bangladesh, Geographical setting of bangladesh, environmental challenges of Bangladesh, Bangladesh foreign policy: realities and challenges, Foreign policy-decision-making process in Bangladesh, Bangladesh-soviet union relations.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
To enrich with brief history, culture and heritage of Bangladesh.												√
To provie in-depth knowledge on the major political events that shaped Bangladesh as an independent sovereign state.							√					
To improve understanding on political, economic and social development of Bangladesh.											√	
To think critically and comprehensively about foreign policy of Bangladesh, its relationship with other countries and its important roles in the international organizations like UN, Commonwealth and SAARC etc.								√				

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2	Ancient period and muslim period of bengal	
2	Lec 3 Lec 4	British period, pakistan period: an overview (1952-1971),	**Class Test 1**
3	Lec 5 Lec 6	The problem of national integration under ayub regime	
4	Lec 7 Lec 8	Elite in crisis during pakistan rule, nation-building in the new state	**Class Test 2**

5	Lec 9 Lec 10	The ideals and philosophy of constitution-making of bangladesh	
6	Lec 11 Lec 12	Study on the coup and assassination of mujib	
7	Lec 13 Lec 14	Philosophy and fundamental changes of zia regime	
8	Lec 15 Lec 16	Constitutional amendments of bangladesh	
9	Lec 17 Lec 18	Corruption and good governance in bangladesh	**Class Test 3**
10	Lec 19 Lec 20	Issues of governance of bangladesh, bangladesh economy	
11	Lec 21 Lec 22	Ideas on political and ethnic conflict in bangladesh	
12	Lec 23 Lec 24	Geographical setting of bangladesh, environmental challenges of bangladesh	
13	Lec 25 Lec 26	Bangladesh foreign policy: realities and challenges	**Class Test 4**
14	Lec 27 Lec 28	Foreign policy-decision-making process in Bangladesh Bangladesh-soviet union relations	

Text and Ref Books:

1. "Bangladesh in International Politics" - Muhammad Shamsul Huq (1995), The University Press Limited, Dhaka-1000
2. "Constitution, Constitutional Law and Politics: Bangladesh Perspective"- Md. Abdul Halim, CCB Foundation, Dhaka-1000
3. "Bangladesh in the Twenty-First Century: Towards an Industrial Society" - A M A Muhith (1999), The University Press Limited, Dhaka-1000
4. "Bangladesh Foreign Policy: Realities, Priorities and Challenges" - Harun ur Rashid (2012, 2nd Edition), Academic Press and Publishers Library, Dhaka-1209
5. "The Changing Pattern of Bangladesh Foreign Policy: A Comparative Study of Mujib and Zia Regimes" - Zaglul Haider (2008), The University Press Limited, Dhaka-1000

HUM- 243 2 hours in a week, 2.00 Cr.

Sociology

Pre-requisite: None

Rationale:

Systematic study of social behavior and human groups. It focuses on the influence of social relationships upon people's attitudes and behavior and on how societies are established and changed. This course provides students with both methodologies and knowledge of the study of critical social issues ranging in scope from family to global.

Objective:

1. To correctly identify critical social issues through a systematic study of social behavior and social change.
2. To demonstrate comprehension of roles and functions of various social institutions, relationships, several sociological theories and apply them to explain social phenomena or situations.
3. To demonstrate interest in taking part in social activities and use sociological imagination to explain their life experience in a broader social context.

Course Outcomes (CO):

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

1. Correctly identify causes of critical social issues through a systematic study of social behavior and social change.
2. Demonstrate comprehension of roles and functions of various social institutions and relationships among them.
3. Demonstrate understanding of several sociological theories and apply them to explain social phenomena or situations.
4. Demonstrate interest in taking part in social activities.

Course Content:

Nature, scope and perspectives of sociology; stages of social research and research methods; culture and civilization; socialization and personality development; globalization; media and individual; social organization and social problem; social stratification; industrial revolution, capitalism and socialism; work and economic life; environment and human activities; climate change and global risk; population and human society; urbanization and city development; social change and technology;

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes (CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Correctly identify causes of critical social issues through a systematic study of social behavior and social change.				√								
Demonstrate comprehension of roles and functions of various social institutions and relationships among them.		√										
Demonstrate understanding of several sociological theories and apply them to explain social phenomena or situations.								√				
Demonstrate interest in taking part in social activities.										√		

Lecture Schedule:

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2	Nature, Scope And Perspectives Of Sociology;	**Class Test 1**
2	Lec 3 Lec 4	Stages Of Social Research And Research Methods	
3	Lec 5 Lec 6	Culture And Civilization	
4	Lec 7 Lec 8	Socialization And Personality Development	**Class Test 2**
5	Lec 9 Lec 10	Globalization	
6	Lec 11 Lec 12	Media And Individual	
7	Lec 13 Lec 14	Social Organization And Social Problem	
8	Lec 15 Lec 16	Social Stratification	**Class Test 3**
9	Lec 17 Lec 18	Industrial Revolution	
10	Lec 19 Lec 20	Capitalism And Socialism	
11	Lec 21 Lec 22	Work And Economic Life Environment And Human Activities	**Class Test 4**

12	Lec 23 Lec 24	Climate Change And Global Risk	
13	Lec 25 Lec 26	Population And Human Society	
14	Lec 27 Lec 28	Urbanization And City Development Social Change And Technology	

Text and Ref Books:

1. “Sociology” – Richard T. Schaefer and Robert P. Lamm, MacGraw-Hill, N.O., 2002)
2. “Social Problems” - LeRoy W. Barnes, The Dushkin Publishing Group, Guilford, CT, 2000
3. “Sociology – Primary Principles” - CN Shankar Rao
4. “Sociology – A Guide to Problems & Literature” – Bottomore
5. “Sociology ” – Samuel Koening

Option-II

CSE-407 **3 hours in a week, 3.00 Cr.**
Applied Statistics and Queuing Theory

Pre-requisite: None

Rationale:

To provide in deep idea of working with data sets and impact of data sets as well as application of queuing models in Computer Science domain.

Objective:

1. To discuss the theories of applied statistics.
2. To select the practical applications in the field of Information Technology and explain the real life applications of statistics.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss the theories of applied statistics.
2. Select the practical applications in the field of Information Technology.
3. Explain the real life applications of statistics.

Course Content:

Introduction; Frequency distribution, Mean, median, Mode and other measure of central tendency standard deviation and other measure of dispersion, Moments, Skewness and kurtosis, Elementary probability theory, Characteristics of distributions, elementary sampling theory, Estimation, Hypothesis testing and regression analysis. Probability distribution and expectations, discontinuous probability distribution, e.g. binomial, position and negative binomial. Continuous probability distributions, e.g. normal and exponential. Queuing Theory: Stochastic processes, Discrete time Markov chain and continuous time Markov Chain. birth-death process in queuing. Queuing models: M/M/1,M/M/C,M/G/1,M/D/1,G/M/1 solution of network of queue-closed queuing models and approximate models. Application of queuing models in Computer Science.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss the theories of applied statistics.	√											
Select the practical applications in the field of Information Technology.		√										
Explain the real life applications of statistics.						√						

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction Frequency distribution	
2	Lec 4 Lec 5 Lec 6	Central Tendency Mean, median, Mode	
3	Lec 7 Lec 8 Lec 9	Standard deviation Dispersion	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Moments Skewness and kurtosis	
5	Lec 13 Lec 14 Lec 15	Elementary probability theory Characteristics of distributions	
6	Lec 16 Lec 17 Lec 18	Elementary sampling theory Estimation	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Hypothesis testing and regression analysis	
8	Lec 22 Lec 23 Lec 24	Probability distribution Expectations	
9	Lec 25 Lec 26 Lec 27	Discontinuous probability distribution Binomial distribution Position and negative binomial distribution	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Continuous probability distributions Normal Distribution Exponential Distribution	
11	Lec 28 Lec 29 Lec 30	Queuing Theory: Stochastic processes Discrete time Markov chain	**Class Test 4**
12	Lec 34 Lec 35	Continuous time Markov Chain Birth-death process in queuing	

	Lec 36		
13	Lec 37 Lec 38 Lec 39	Queuingmodels: M/M/1,M/M/C,M/G/1,M/D/1,G/M/1 Queue-closed queuing models	
14	Lec 40 Lec 41 Lec 42	Approximate models Application of queuing models	

Text and Ref Books:

1. Applied Statistics - Rebecca (Becky) M. (Margaret) Warner
2. Applied Statistics for Engineers and Scientists - Jay L. Devore and Nicholas R. Farnum
3. An Introduction to Queuing Theory - U. Narayan Bhat
4. Probability, Markov Chains, Queues, and Simulation: The Mathematical Basis of Performance Modeling - William J. Stewart

CSE-419 3 hours in a week, 3.00 Cr.
Advanced Algorithms

Pre-requisite: None

Rationale:

This course motivates to implement advanced methods of algorithmic design, analysis, and implementation. techniques that include amortization, randomization, word-level parallelism, bit scaling, dynamic programming, network flow, linear programming, fixed-parameter algorithms, approximation algorithms etc. to identify which algorithm will provide efficient result for a specific problem or context.

Objective:

1. To study advanced techniques and recognize the resource requirements of various algorithms and their applications to solve and approximate real life problems.
2. To analyze the complexity and design necessary parameters of different techniques and methods of advanced algorithms.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Select and explain a variety of algorithms with practical applications and the resource requirements of each.
2. Determine the most suitable algorithm for any given task and then apply it to the problem.
3. Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Select and explain a variety of algorithms with practical applications and the resource requirements of each.		√										
2. Determine the most suitable algorithm for any given task and then apply it to the problem.			√									
3. Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Advanced Algorithms Applications of Advanced Algorithms Fundamental Algorithms versus Advanced Algorthms	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Randomized Algorithms Las Vegas Algorithm Las Vegas Algorithm (Contd.)	
3	Lec 7 Lec 8 Lec 9	Monte Carlo Algorithm Monte Carlo Algorithm (Contd.) Randomized Data Structures	
4	Lec 10 Lec 11 Lec 12	Skip Lists Amortized Analysis Amortized Analysis Methods	**Class Test 2**
5	Lec 13	Amortized Analysis Methods (Contd.)	

	Lec 14 Lec 15	Applications in Fibonacci Heaps Lower Bounds	
6	Lec 16 Lec 17 Lec 18	Decision Trees Decision Trees (Contd.) Information Theoretic Lower Bounds	
7	Lec 19 Lec 20 Lec 21	Adversary Arguments Approximation Algorithms Approximation Algorithms (Contd.)	
8	Lec 22 Lec 23 Lec 24	Approximation Schemes Approximation Schemes (Contd.) Hardness of Approximation	
9	Lec 25 Lec 26 Lec 27	Fixed Parameter Tractability Parameterized Complexity Parameterized Complexity (Contd.)	
10	Lec 31 Lec 32 Lec 33	Fixed Parameter Algorithms Techniques of Designing Fixed Parameter Algorithms Techniques of Designing Fixed Parameter Algorithms	**Class Test 3**
11	Lec 28 Lec 29 Lec 30	Online Algorithms Online Algorithms (Contd.) Online Algorithms (Contd.)	
12	Lec 34 Lec 35 Lec 36	Competitive Analysis Online Paging Problem k-server Problem	
13	Lec 37 Lec 38 Lec 39	External Memory Algorithms External Memory Algorithms (Contd.) External Memory Algorithms (Contd.)	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Advanced Data Structures Linear Models Non-linear Models	

Text and Ref Books:

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

CSE-421 — 3 hours in a week, 3.00 Cr.
Basic Graph Theory

Pre-requisite: None

Rationale:
Provides a framework to model a large set of problems in CS for better mathematical structures and pairwise relations between objects.

Objective:

1. To learn the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications.
2. To formulate algorithms to solve problems with graph theories

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Learn the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications.
2. Explain and discuss mathematical proofs, including an appreciation of why this is important.
3. Formulate algorithms to solve problems with graph theories

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Learn the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications.	√											
Explain and discuss mathematical proofs, including an appreciation of why this is important.				√								
Formulate algorithms to solve problems with graph theories			√									

Lecture Schedule

Week	**Lecture**	**Topics**	**Class Test**
1	Lec 1 Lec 2 Lec 3	Graphs and their applications	
2	Lec 4 Lec 5	Basic graph terminologies	**Class Test 1**

	Lec 6		
3	Lec 7 Lec 8 Lec 9	Basic operations on graphs	
4	Lec 10 Lec 11 Lec 12	Graph representations	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Degree sequence and graphic sequence	
6	Lec 16 Lec 17 Lec 18	Paths Cycles Connectivity	
7	Lec 19 Lec 20 Lec 21	Network flow	
8	Lec 22 Lec 23 Lec 24	Euler tours Hamiltonian cycles Ear decomposition	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Trees and counting of trees	
10	Lec 31 Lec 32 Lec 33	Distance in graphs Distance in trees	
11	Lec 28 Lec 29 Lec 30	Graceful labeling Matching and covering	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Planar graphs	
13	Lec 37 Lec 38 Lec 39	Digraphs Graph coloring	
14	Lec 40 Lec 41 Lec 42	Special classes of graphs	

Text and Ref Books:

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

CSE-423 **3 hours in a week, 3.00 Cr.**

Fault Tolerant System

Pre-requisite: None

Rationale:

This course motivates to implement a feature on a system that enables a system to continue with its operations even when there is a failure on one part of the system and helps in fault isolation through various failure detection mechanisms.

Objective:

1. To detect and isolate faults on a system and design accordingly to achieve a fault tolerant system using different fault tolerance design techniques.
2. To test and analyze the faults in order to create a reliable and high performance system.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss, explain and analyze underlying notions of fault tolerance.
2. Model reliability of different types of systems.
3. Recognize defect avoidance and circumvention.
4. Identify methodologies of hardening systems.

Course Content :

Introduction of Fault Tolerant Systems and architectures; Goal and Application of Fault Tolerant computing, Fundamental Definitions, Design techniques to achieve fault Tolerance,Reliability Modeling Using Probability Theory, Fault detection and location in combinational and sequential circuits; Fault test generation for combinational and sequential circuits; Fault modeling; Faults in memory, memory test pattern and reliability;Performance monitoring, self-checking circuits, burst error correction and triple modular redundancy, Defect Avoidance,Defect Circumvention, Shield and Hardening,Yields Enhancement, Degradation Allowance.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss, explain and analyze underlying notions of fault tolerance		√										
2. Model reliability of different types of systems.			√									
3. Recognize defect avoidance and circumvention.		√										
4. Identify methodologies of hardening systems.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Fault Tolerant Systems Goals of Fault Tolerant Computing Applications of Fault Tolerant Computing	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Fundamental Definitions Design Techniques to Achieve Fault Tolerance Architecture of Fault Tolerant System	
3	Lec 7 Lec 8 Lec 9	Reliability Modeling using Probability Theory Reliability Modeling using Probability Theory (Contd.) Fault Detection and Location	
4	Lec 10 Lec 11 Lec 12	Fault Detection and Location in Sequential Circuit Fault Detection and Location in Combinational Circuit Fault Modeling	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Fault Test Fault Test Generation for Sequential Circuit Fault Test Generation for Combinational Circuit	
6	Lec 16 Lec 17 Lec 18	Faults in Memory Memory Test Pattern Memory Test Reliability	
7	Lec 19 Lec 20 Lec 21	Performance Monitoring Performance Monitoring (Contd.) Self-checking circuits	
8	Lec 22 Lec 23 Lec 24	Errors Error Types Error Types (Contd.)	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Error Correction Burst Error Burst Error Correction	
10	Lec 31 Lec 32 Lec 33	N-modular Redundancy Triple Modular Redundancy Triple Modular Redundancy (Contd.)	
11	Lec 28 Lec 29 Lec 30	Defect Defect Types Defect Avoidance	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Defect Avoidance (Contd.) Defect Circumvention Defect Circumvention (Contd.)	
13	Lec 37 Lec 38 Lec 39	Hardening Systems Methods of Hardening Shield Hardening (Contd.)	
14	Lec 40 Lec 41 Lec 42	Yields Enhancement Yields Enhancement (Contd.) Degradation Allowance	

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

CSE-425 — 3 hours in a week, 3.00 Cr.
Basic Multimedia Theory

Pre-requisite: None

Rationale:
This course motivates to study the architecture, different standards of compressing and coding a multimedia document; database, network and operating system issues, traffic and service issues, security issues and hence apply this knowledge to implement different multimedia applications.

Objective:
1. To apply different techniques and methods for developing secured and high quality multimedia applications for different context.
2. To recognize and analyze different issues - storing, indexing, resource management, scheduling, security etc. of multimedia applications.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Discuss indexing and storing multimedia data for multimedia document.
2. Explain disk placement, disk scheduling, searching techniques for multimedia document.
3. Discover and apply the knowledge acquired in developing multimedia applications – audio and video conferencing, video on demand, and voice over IP.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Discuss indexing and storing multimedia data for multimedia document.	√											
2. Explain disk placement, disk scheduling, searching techniques for multimedia document.			√									
3. Discover and apply the knowledge acquired in developing multimedia applications – audio and video conferencing, video on demand, and voice over IP.				√								

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Multimedia Systems Introduction to Multimedia Systems (Contd.) Application of Multimedia Systems	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Coding Standards Compression Standards Architecture Issues in Multimedia	
3	Lec 7 Lec 8 Lec 9	Architecture Issues in Multimedia (Contd.) Operating System Issues in Multimedia Real-time OS Issues	
4	Lec 10 Lec 11 Lec 12	Synchronization Issues Interrupt Handling Interrupt Handling (Contd.)	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Database Issues in Multimedia Indexing Multimedia Data Storing Multimedia Data	
6	Lec 16 Lec 17 Lec 18	Storing Multimedia Data (Contd.) Disk Placement Disk Scheduling	
7	Lec 19 Lec 20 Lec 21	Disk Scheduling (Contd.) Searching for a Multimedia Document Networking Issues in Multimedia	
8	Lec 22 Lec 23 Lec 24	Quality-of-Service guarantees Resource Reservation Traffic Specification	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Shaping Monitoring Admission Control	
10	Lec 31 Lec 32 Lec 33	Multicasting Issues Multicasting Issues (Contd.) Session Directories	
11	Lec 28 Lec 29	Protocols for Controlling Sessions Protocols for Controlling Sessions (Contd.)	

	Lec 30	Security Issues in Multimedia	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Security Issues in Multimedia (Contd.) Digital Water Making Partial Encryption Schemes for Video Streams	
13	Lec 37 Lec 38 Lec 39	Multimedia Applications Audio Conferencing Video Conferencing	
14	Lec 40 Lec 41 Lec 42	Video on Demand Voice over IP Voice over IP (Contd.)	

Text and Ref Books:

1. Multimedia: Computing, Communications & Applications (US Edition) - Ralf Steinmetz, Klara Nahrstedt; Prentice Hall (1995)

CSE-427 — 3 hours in a week, 3.00 Cr.

Digital Image Processing

Pre-requisite: None

Rationale:
Introduce the fundamentals of image processing and manipulation of television, medical imaging modalities such as X-ray or ultrasound, photography, security, astronomy and remote sensing.

Objective:

1. To describe image formation and the role human visual system plays in perception of gray and color image data.
2. To explain the basic elements and applications of image processing.
3. To select and analyze image sampling and quantization requirements and implications.
4. To perform Gray level transformations for Image enhancement.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Describe image formation and the role of human visual system in perception of gray and color image data.
2. Explain the basic elements and applications of image processing.
3. Select and analyze image sampling and quantization requirements and implications.
4. Perform Gray level transformations for Image enhancement.

Course Content :

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe image formation and the role of human visual system in perception of gray and color image data.	√											
Explain the basic elements and applications of image processing.	√											
Select and analyze image sampling and quantization requirements and implications.		√										
Perform Gray level transformations for Image enhancement.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Digital image fundamentals Visual perception Light and Electrom gnetic Spectrum	
2	Lec 4 Lec 5 Lec 6	Image Sensing and Acquisition Image Sampling and Quantization Basic relationships between pixels	
3	Lec 7 Lec 8 Lec 9	Linear and Nonlinear operations Image transforms First Fourier Transform (FFT)	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Discrete Cosine Transform (DCT) Karhunen and Loeve Transform (KLT)	
5	Lec 13 Lec 14 Lec 15	Wavelet Transform	**Class Test 2**
6	Lec 16 Lec 17 Lec 18	Sub-Band Decomposition	
7	Lec 19 Lec 20	Image restoration technique Properties of Noise	

	Lec 21	Estimation of Noise Parameters	
8	Lec 22 Lec 23 Lec 24	Filters Mean Filter Bandpass and Band reject Filter Notch Filter and Inverse Filter	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Color Image Processing Fundamentals, Models Smoothing and Sharpening	
10	Lec 31 Lec 32 Lec 33	Image compression techniques Coding Redundancy Measuring Image Information	
11	Lec 28 Lec 29 Lec 30	Image compression standards JPEG, MPEG, H.261, and H.26	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Image Enhancement in the Frequency Domain	
13	Lec 37 Lec 38 Lec 39	Image Segmentation Detection of Discontinuities Thresholding	
14	Lec 40 Lec 41 Lec 42	Edge Linking Boundary Detection	

Text and Ref Books:

1. Digital Image Processing (3rd/2nd Edition) - R. C. Gonzalez and R.E. Woods; Pearson Prentice Hall (2009)

CSE-431 — 3 hours in a week, 3.00 Cr.

Object Oriented Software Engineering

Pre-requisite: None

Rationale:

This course provides in depth concepts, properties, relationships of object driven software, exception handling and reusable library.

Objective:

1. To describe various O-O concepts, their properties, relationships along with model/ represent considering constraints.

2. To design, develop and explain various modeling techniques to model different perspectives of Object-Oriented Software Design.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe various O-O concepts along with their applicability contexts.
2. Identify domain objects, their properties, and relationships among them.
3. Model/ represent domain constraints on the objects and (or) on their relationships.
4. Develop design solutions for problems on various O-O concepts.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe various O-O concepts along with their applicability contexts.	√											
Identify domain objects, their properties, and relationships among them.		√										
Model/ represent domain constraints on the objects and (or) on their relationships.		√										
Develop design solutions for problems on various O-O concepts.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Object-oriented approach	
2	Lec 4	Basic (procedural) elements of language	

	Lec 5 Lec 6		**Class Test 1**
3	Lec 7 Lec 8 Lec 9	Eiffel program Instruction set Entities (variables) and routines;	
4	Lec 10 Lec 11 Lec 12	Concepts underlying the O-O approach Modularity	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Inheritance Dynamic binding Management information-system domain	
6	Lec 16 Lec 17 Lec 18	Environment matters: system configuration,	
7	Lec 19 Lec 20 Lec 21	Interfacing with external software Garbage collection.	
8	Lec 22 Lec 23 Lec 24	Advanced issues involving exception handling	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Repeated inheritance Typing problems	
10	Lec 31 Lec 32 Lec 33	Parallelism O-O software engineering process	
11	Lec 28 Lec 29 Lec 30	OOAD to a maintainable Addresses verification	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	OOAD to Address validation (V&V) Issues of Eiffel software systems	
13	Lec 37 Lec 38 Lec 39	Building reusable libraries	
14	Lec 40 Lec 41 Lec 42	The building of a parallel linear algebra library (Paladin).	

Text and Ref Books:

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

CSE-433 **3 hours in a week, 3.00 Cr.**

Artificial Neural Networks and Fuzzy Systems

Pre-requisite: None

Rationale:

Reasoning complex situations by the artificial agents with the help of neural network and fuzzy system provides better performance.

Objective:

1. To develop the skills on neural network theory and fuzzy logic theory and explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.
2. To design and implement basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
2. Explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.
3. Select and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory	√											
Explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.		√										
Select and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Biological nervous system Brain and neurons	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Introduction to artificial neural network and fuzzy systems	
3	Lec 7 Lec 8 Lec 9	Adaption of Artificial neural networks Fuzzy logic	
4	Lec 10 Lec 11 Lec 12	Multi-layer perception Back propagation algorithm Self-organization map	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Radial basis network Hop field network Recurrent network	
6	Lec 16 Lec 17 Lec 18	Fuzzy set theory Failing Adaptive Linear (ADALINE) Multiple Adaptive Linear (MADALINE)	
7	Lec 19 Lec 20 Lec 21	Generating internal representation Cascade correlation Counter propagation networks	
8	Lec 22 Lec 23 Lec 24	Higher order bi-directional associated memory Lyapunov energy function	**Class Test 3**
9	Lec 25 Lec 26	Attraction basin Probabilistic updates: simulated annealing	

	Lec 27	Boltzmann machine	
10	Lec 31 Lec 32 Lec 33	Adaptive Resonance Theory (ART) network. ARTI. ART2.	
11	Lec 28 Lec 29 Lec 30	Fuzzy ART mapping (ARTMAF) Kohonen feature LVQ networks	
12	Lec 34 Lec 35 Lec 36	Logic control Adaptive fuzzy neural network	
13	Lec 37 Lec 38 Lec 39	Genetic algorithm Evolution compacting Applications to control	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Pattern recognition Nonlinear system modeling Speech and image processing.	

Text and Ref Books:

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

CSE-435 — 3 hours in a week, 3.00 Cr.

Distributed Algorithms

Pre-requisite: None

Rationale:

Execution of algorithms in parallel and distributed settings along with correctness, reliability, security, and performance is very vital for computing.

Objective:

1. To acquire concepts of models, limitations, and fundamentals of message passing and shared memory concurrency, and apply this understanding to example systems and algorithms.

2. Adapt, design algorithms and distinguish for execution in parallel and distributed settings along with correctness, reliability, security, and performance.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss and account for models, limitations, and fundamental concepts in the area of message passing and shared memory concurrency, and apply this understanding to example systems and algorithms.
2. Adapt, and design algorithms for execution in parallel and distributed settings.
3. Distinguish the algorithms for correctness, reliability, security, and performance.

Course Content:

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

Teaching-learning and Assessment Strategy:
Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss and account for models, limitations, and fundamental concepts in the area of message passing and shared memory concurrency, and apply this understanding to example systems and algorithms.	√											
Adapt, and design algorithms for execution in parallel and distributed settings.			√									
Distinguish the algorithms for correctness, reliability, security, and performance.		√										

Lecture Schedule

Week	**Lecture**	**Topics**	**Class Test**
1	Lec 1 Lec 2 Lec 3	Models of distributed computing	
	Lec 4 Lec 5 Lec 6	Synchrony communication	
3	Lec 7 Lec 8 Lec 9	Failure concerns	**Class Test 1**
4	Lec 10	Synchronous message-passing	**Class Test 2**

	Lec 11 Lec 12		
5	Lec 13 Lec 14 Lec 15	Distributed systems	
6	Lec 16 Lec 17 Lec 18	Algorithms in systems with no failures - Leader Election	
7	Lec 19 Lec 20 Lec 21	Breadth-First Search algorithms	
8	Lec 22 Lec 23 Lec 24	The atomic commit problem	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Consensus problems - the Byzantine Generals Problem	
10	Lec 31 Lec 32 Lec 33	Asynchronous message-passing of distributed systems	
11	Lec 28 Lec 29 Lec 30	Failure detectors I	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Failure detectors II	
13	Lec 37 Lec 38 Lec 39	Logical time Vector clocks	
14	Lec 40 Lec 41 Lec 42	Routing algorithms	

Text and Ref Books:

1. Distributed Systems - S. Mullender (ed.), Addison-Wesley
2. Introduction to Distributed Algorithms - G. Tel. Cambridge Univ. Press

CSE-437 — 3 hours in a week, 3.00 Cr.
Bioinformatics

Pre-requisite: None

Rationale:

This course motivates to generate all sorts of data that involves generating protein sequence and predicting protein domains to even producing 3D structures of proteins from computer based databases of biological information for bioinformatics experiments.

Objective:

1. To be able to work with the vast amount of biomedical and genomic data using bioinformatics tools.
2. To analyze the properties of different genome sequences and their alignment from databases using dynamic programming.

Course Outcomes (CO):
Upon completion of the course, the students will be able to:
1. Explain and learn the knowledge of basic topics regarding bioinformatics.
2. Define and describe the contents and properties of the most important bioinformatics databases and searches.
3. Enhance the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming.

Course Content :

Molecular biology basics: DNA, RNA, genes, and proteins; Genome Rearrangements. Sequence similarity, homology, and alignment. Pair-wise alignment: scoring model, dynamic programming algorithms, heuristic alignment, and pair-wise alignment using Hidden Markov Models. Combinatorial pattern matching: Database Search, Rapid String Matching, BLAST, FASTA; Multiple alignment: scoring model, local alignment gapped and un-gapped global alignment. Motif finding: motif models, finding occurrence of known sites, discovering new sites. Gene Finding: predicting reading frames, maximal dependence decomposition. Analysis of DNA microarray data using hierarchical clustering, model-based clustering, expectation-maximization clustering, Bayesian model selection.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Explain and learn the knowledge of basic topics regarding bioinformatics.	√											

2. Define and describe the contents and properties of the most important bioinformatics databases and searches.	√											
3. Enhance the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Bioinformatics Applications of Bioinformatics Molecular Biology Basics	
2	Lec 4 Lec 5 Lec 6	DNA and RNA Genes Proteins	
3	Lec 7 Lec 8 Lec 9	Genome Rearrangements Sequence Similarity Homology	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Alignment Pair-wise Alignment Scoring Model Pair-wise Alignment Scoring Model (Contd.)	
5	Lec 13 Lec 14 Lec 15	Dynamic Programming Algorithms Dynamic Programming Algorithms (Contd.) Heuristic Alignment	**Class Test 2**
6	Lec 16 Lec 17 Lec 18	Hidden Markov Model Pair-wise Alignment using HMM Pair-wise Alignment using HMM (Contd.)	
7	Lec 19 Lec 20 Lec 21	Combinatorial Pattern Matching Database Search Rapid String Matching	
8	Lec 22 Lec 23 Lec 24	BLAST FASTA Multiple Alignment Scoring Model	
9	Lec 25 Lec 26 Lec 27	Local Alignment Gapped Global Alignment Un-gapped Global Alignment	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Motif Finding: Motif Models Finding Occurence of Known Sites Discovering New Sites	
11	Lec 28 Lec 29 Lec 30	Gene Finding Predicting Reading Frames Maximal Dependence Decomposition	
12	Lec 34 Lec 35 Lec 36	Analysis of DNA Microarray Data Hierarchical Clustering Hierarchical Clustering (Contd.)	**Class Test 4**
13	Lec 37	Model Based Clustering	

	Lec 38 Lec 39	Model Based Clustering (Contd.) Expectation Maximization Clustering	
14	Lec 40 Lec 41 Lec 42	Expectation Maximization Clustering (Contd.) Bayesian Model Selection Bayesian Model Selection (Contd.)	

Text and Ref Books:

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

CSE-439 — 3 hours in a week, 3.00 Cr.

Robotics

Pre-requisite: None

Rationale:

This course introduces the fundamentals of robotics design and development, the principles of robot kinematics, dynamics, motion planning, trajectory generation and control as well as plan and research complete robots for various industrial applications.

Objective:

1. To explain the basics of robotic systems, robot design, development process and their vast applications.
2. To specify and analyze the simulation, modeling and drawbacks of a robotic system for an interactive complex environment.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Explain with the concept development and key components of robotics technologies.
2. Solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.
3. Design and implement a robotic project on a physical mobile robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modeling, control and obstacle avoidance in a complex and interactive environment.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain with the concept development and key components of robotics technologies.	√											
Solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.		√										
Design and implement a robotic project on a physical mobile robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modeling, control and obstacle avoidance in a complex and interactive environment.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Robotics Applications of Robotics Evolution of Robotics	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Overview of Robot Mechanisms Overview of Robot Dynamics Overview of Robot Intelligent Controls	
3	Lec 7 Lec 8 Lec 9	Spatial Descriptions Transformations Introduction to Kinematics	
4	Lec 10 Lec 11 Lec 12	Planar Kinematics Spatial Kinematics Motion Planning	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Mechanism Design for Manipulators Mechanism Design for Mobile Robots Mechanism Design for Mobile Robots (Contd.)	
6	Lec 16 Lec 17 Lec 18	Manipulator Kinematics Inverse Manipulator Kinematics Introduction to Dynamics	
7	Lec 19 Lec 20	Manipulator Dynamics Trajectory Generation	

	Lec 21	Multi-rigid body Dynamics	
8	Lec 22 Lec 23 Lec 24	Linear Control of manipulators Non-Linear Control Manipulators Force Control of Manipulators	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	3D Graphic Simulation 3D Graphic Simulation (Contd.) 3D Graphic Simulation (Contd.)	
10	Lec 31 Lec 32 Lec 33	Control Design Actuators Sensors	
11	Lec 28 Lec 29 Lec 30	Task Modeling, Face Control and Haptics Human-Machine Interface Embedded Software Mechanical Design	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Jacobean Kinematics Inverse Kinematics Redundant and Parallel Robots	
13	Lec 37 Lec 38 Lec 39	Micro Robotics Nano-Robotics Mobile Robots	
14	Lec 40 Lec 41 Lec 42	Human-robot interaction Multiagents Fault Diagnosis	

Text and Ref Books:

1. Introduction to Robotics: Analysis, Control, Applications (2nd Edition) - Saeed B. Niku; Wiley (2010)
2. Introduction to Robotics: Mechanics and Control (3rd Edition) - John J. Craig; Pearson (2004)

CSE-447 — 3 hours in a week, 3.00 Cr.
Telecommunication Engineering

Pre-requisite: None

Rationale:

This course motivates to design and install equipment used for transmitting wired phone, cellular, cable and broadband data as well as working with copper or fiber optic cabling, complex networks and switching systems in order to enable companies to communicate effectively with customers and deliver high standards of customer service.

Objective:

1. To perceive knowledge regarding different components and techniques of telecommunication system.

2. To specify problems and design various telecommunication system and networks for solving the respective problems.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate theoretical and technical knowledge of telecommunications systems associated with LANs, MANs, and WANs.
2. Learn to design, implement, and manage telecommunications systems using voice and data
3. Model and simulate telecommunications systems and networks in order to identify and solve these problems.
4. Acquire the knowledge and expertise in the field of telecommunication hardware.

Course Content :

Introduction: overview of telecommunication; history, evolution, convergence of telecommunication and data networks; National and International regulatory bodies; Basic elements of Telecommunication: Telephone apparatus, microphone, speaker, ringer, pulse and tone dialing mechanism; local and central batteries and advanced systems of power supplies; Transmission media: Characteristics and applications of twisted pairs, coaxial cables and optical fibers, Terrestrial and satellite microwave, radio waves, VSAT; Telephone operating principles: telephone equipment, description of the modern phone; Telephone switching systems: PSTN, PBX, standards; Basics of communication systems: modulation, multiplexing; Switching system: circuit switching, packet switching; Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing; Integrated services digital network (ISDN), Digital subscriber loop (DSL), Data communication equipment: Tele-Traffic analysis; Cellular telephony: Frequency reuse, frequency management, channel alignment, handoff strategies, FDMA, TDMA, CDMA and GSM, Introduction to satellite communication, Optical fiber communication, Submarine cables, Digital Radio Microwave, etc.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Demonstrate theoretical and technical knowledge of telecommunications systems associated with LANs, MANs, and WANs.	√											
2. Learn to design, implement, and manage telecommunications systems using voice and data.			√									
3. Model and simulate telecommunications systems and networks in order to identify and solve these problems.				√								
4. Acquire the knowledge and expertise in the field of telecommunication hardware.	√											

Lecture Schedule

Week	Lecture	Top cs	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction: Overview of Telecommunication History of Telecommunication Evolution of Telecommunication	
2	Lec 4 Lec 5 Lec 6	Convergence of Telecommunication Data Networks Introduction: Regulatory Bodies	
3	Lec 7 Lec 8 Lec 9	National Regulatory Bodies International Regulatory Bodies International Regulatory Bodies (Contd.)	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Basic Elements of Telecommunication, Telephone Apparatus Microphone, Speaker and Ringer Pulse and Tone Dialing Mechanism, Local and Central Batteries	
5	Lec 13 Lec 14 Lec 15	Advanced Systems of Power Supplies Transmission Media Characteristics and Applications: Twisted Pairs	**Class Test 2**
6	Lec 16 Lec 17 Lec 18	Characteristics and Applications: Coaxial Cable Characteristics and Applications: Optical Fibers Terrestrial Microwave	
7	Lec 19 Lec 20 Lec 21	Satellite Microwave VSAT Radio Waves	
8	Lec 22 Lec 23 Lec 24	Telephone Operating Principles Telephone Equipment Description of a Modern Phone	
9	Lec 25 Lec 26 Lec 27	PSTN, PBX Standards Modulation Multiplexing	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Switching System Circuit Switching Packet Switching	
11	Lec 28 Lec 29 Lec 30	Traffic Characterization Traffic Analysis Grades of Service	
12	Lec 34 Lec 35 Lec 36	ISDN DSL Cellular Telephony	
13	Lec 37 Lec 38 Lec 39	FDMA, CDMA TDMA, GSM Introduction to Satellite Communication	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Optical Fibre Communication Submarine Cables Digital radio Microwave	

Text and Ref Books:

1. Introduction to Telecommunication: Voice, Data and the Internet (1st Edition) – Marion Cole; Prentice Hall (2010)
2. Essential Guide to Telecommunications (5th Edition) - Annabel Z. Dodd; Prentice Hall (2012)
3. Optical Fiber Communication: Principles and Practice (3rd Edition) – John M Senior; Pearson (2010)
4. Modern Digital and Analog Communication System (4th Edition) – B P Lathi; Oxford (2011)

Option-III

CSE-411 3 hours in a week, 3.00 Cr.

VLSI Design

Pre-requisite: None

Rationale:

This course motivates to enhance the ability to design large integrated digital electronic circuits using various logic and circuit design techniques and contribute to the electronics engineering and have a better understanding of different characteristics of such circuits.

Objective:

1. To recognize different logical components as well as their interconnection and design various integrated electronic circuits to perform certain digital functions.
2. To study and analyze different properties, behaviour and performance metrics of different integrated digital electronic circuits.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.
2. Select, analyze and create models of moderately sized CMOS circuits that realize specified digital functions.
3. Solve and apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.

4. Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.

Course Content :

VLSI design methodology: Top-down Design Approach, Technology Trends and Design Automation Algorithms; Introduction to CMOS Inverters and Basic Gates; CMOS Fabrication Process and Layout; CMOS Circuit Characteristics and Performance Estimation; Buffer Circuit Design; Introduction Bi-CMOS Circuits; Complex CMOS Gates; CMOS layout design rules, CMOS Building Blocks - Adder, Comparator, Multiplier, Counter, and Shifter; Data Path and Memory structures. Design Methodology and Tools; PLA, FPGA, cell-based and full custom design methods, System-on chip design, Hardware modeling - Hardware Modeling Languages, Logic Networks, State Diagrams, Data-flow and Sequencing Graphs, Behavioral Optimization; Floor Planning and Architecture Design.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Describe mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnection.	√											
2. Select, analyze and create models of moderately sized CMOS circuits that realize specified digital functions.		√										
3. Solve and apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects.			√									
4. Have an understanding of the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to VLSI design diodes, BJTs and MOSFETs NMOS and CMOS	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Internal Structure of MOSFETs Hierarchical Design Inverter Principles	
3	Lec 7 Lec 8 Lec 9	Threshold Voltage Ids Calculation for Saturation Region Ids Calculation for Resistive Region	
4	Lec 10 Lec 11 Lec 12	Characteristics Curves Characteristics Curves (Contd.) NMOS Inverter with Resistive Load	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	NMOS Inverter with Enhancement Load Inverter Ratio for NMOS Inverter with Enhancement Load Problems with Enhancement Transistor	
6	Lec 16 Lec 17 Lec 18	NMOS Inverter with Depletion Load Rise Time Calculation Fall Time Calculation	
7	Lec 19 Lec 20 Lec 21	CMOS Characteristics Curve CMOS Power and Transfer Curve Pass Transistor Principles	
8	Lec 22 Lec 23 Lec 24	Pass Transistor NMOS Ratioless NMOS Inverter CMOS Pulse Gate	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Buffer Circuits Buffer Chain Super Buffer	
10	Lec 31 Lec 32 Lec 33	Power Dissipation Static Power Dissipation Dynamic Power Dissipation	
11	Lec 28 Lec 29 Lec 30	Short Circuit Power Dissipation CMOS Noise Margin CMOS Noise Margin (Contd.)	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	NMOS Noise Margin NMOS NAND and NOR Gates CMOS NAND and NOR Gates	
13	Lec 37 Lec 38 Lec 39	Stick Diagrams Design Rules of Geometric Layout	

		Circuit Design using Stick Diagrams and Geometric Layout	
14	Lec 40 Lec 41 Lec 42	n-well Formation Oxide Layer Formation Cross Section of CMOS	

Text and Ref Books:

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

CSE-412 — 1.50 hours in a week, 0.75 Cr.

VLSI Design Sessional

Pre-requisite: None

Rationale:

This course motivates to use different software – PSpice, Microwind, DSCH etc. to model and simulate different digital logic functions and verify their functionalities and other characteristics in order to develop a complete VLSI project following required aim and drawbacks.

Objective:

1. To design schema of different DC and MOSFET circuits using a variety of software and validate different logical functions.
2. To analyze the timing, functionality and other properties of different CMOS circuits,

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Select, analyze and create models of moderately sized CMOS circuits that realize specified digital functions practically.
2. Calculate and apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and verify the functionality, timing, power, and parasitic effects.
3. Use practical knowledge to enhance one’s ability to complete a significant VLSI design project, having a set of objective criteria and design constraints.

Course Content :

PSpice coding (DC circuits), PSpice coding (MOSFET circuits), Circuit schema drawing using DSCH software (MOSFET circuits), Stick diagram drawing using Microwind software (MOSFET circuits)

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, lab test, quiz, viva.

Assessment Methods & their Weights:

Category	Marks %
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Select, analyze and create models of moderately sized CMOS circuits that realize specified digital functions practically.						√						
2. Calculate and apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and verify the functionality, timing, power, and parasitic effects.									√			
3. Use practical knowledge to enhance one's ability to complete a significant VLSI design project, having a set of objective criteria and design constraints.										√		

Lecture Schedule

Week	Lecture	Topics
1	Lec 1 Lec 2 Lec 3	Introducton to IC Technology Related VLSI Technology Basic MOS Transistors
2	Lec 4 Lec 5 Lec 6	Introduction to PSpice Coding Introduction to PSpice Coding (Contd.) Introduction to PSpice Coding (Contd.)
3	Lec 7 Lec 8 Lec 9	PSpice Coding (DC Circuits) Home Assignment Lab Assignment
4	Lec 10 Lec 11 Lec 12	PSpice Coding (DC Circuits) (Contd.) Home Assignment Lab Assignment
5	Lec 13 Lec 14 Lec 15	PSpice Coding (MOSFET Circuits) Home Assignment Lab Assignment
6	Lec 16 Lec 17 Lec 18	PSpice Coding (MOSFET Circuits) (Contd.) Home Assignment Lab Assignment
7	Lec 19 Lec 20 Lec 21	Introduction to DSCH Software Introduction to DSCH Software (Contd.) Introduction to DSCH Software (Contd.)
8	Lec 22 Lec 23 Lec 24	DSCH Software Coding (MOSFET Circuits) Home Assignment Lab Assignment
9	Lec 25 Lec 26 Lec 27	DSCH Software Coding (MOSFET Circuits) (Contd.) Home Assignment Lab Assignment
10	Lec 31 Lec 32 Lec 33	Introduction to Microwind Software Introduction to Microwind Software (Contd.) Introduction to Microwind Software (Contd.)
11	Lec 28 Lec 29 Lec 30	Stick Diagram Drawing using Microwind Software Stick Diagram Drawing using Microwind Software (Contd.) Stick Diagram Drawing using Microwind Software (Contd.)
12	Lec 34 Lec 35 Lec 36	Stick Diagram Drawing using Microwind Software Stick Diagram Drawing using Microwind Software (Contd.)

		Stick Diagram Drawing using Microwind Software (Contd.)
13	Lec 37 Lec 38 Lec 39	Lab Test Lab Test (Contd.) Lab Test (Contd.)
14	Lec 40 Lec 41 Lec 42	Quiz Viva Viva (Contd.)

Text and Ref Books:

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

CSE-441 — 3 hours in a week, 3.00 Cr.

Machine Learning

Pre-requisite: None

Rationale:

Machine learning provides appropriate learning algorithm to best suit the current need and enhance the learning parameters for maximum performance.

Objective:

1. To learn paradigms in different environmental setting and apply the appropriate learning algorithm to best suit the current need.
2. To enhance the learning parameters to achieve maximum performance.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Discuss the different learning paradigms in different environmental setting
2. Select and apply the appropriate learning algorithm to best suit the current need.
3. Enhance the learning parameters to achieve maximum performance.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Discuss the different learning paradigms in different environmental setting.	√											
Select and apply the appropriate learning algorithm to best suit the current need.		√										
Enhance the learning parameters to achieve maximum performance.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Machine Learning	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Regression analysis Logistic Regression	
3	Lec 7 Lec 8 Lec 9	Linear Regression	
4	Lec 10	Supervised learning	**Class Test 2**

	Lec 11 Lec 12	Unsupervised learning	
5	Lec 13 Lec 14 Lec 15	Bayesian Learning Decision Tree Learning	
6	Lec 16 Lec 17 Lec 18	Rule based learning Instance based learning	
7	Lec 19 Lec 20 Lec 21	Neural Nets	
8	Lec 22 Lec 23 Lec 24	Support Vector Machine Genetic Algorithms	
9	Lec 25 Lec 26 Lec 27	Reinforcement learning	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Ensemble learning	
11	Lec 28 Lec 29 Lec 30	Hidden Markov Models	
12	Lec 34 Lec 35 Lec 36	Maximum Likelihood Estimates	
13	Lec 37 Lec 38 Lec 39	Parameter Estimation	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Computational learning theory	

Text and Ref Books:

1. Pattern Recognition and Machine Learning - Christopher M. Bishop; Springer
2. Machine Learning - Tom Mitchell, McGraw Hill
3. Pattern Recognition –SergiosTheodoridis and KonstantinosKoutroumbas; Elsevier Inc.

CSE-442 — 1.50 hours in a week, 0.75 Cr.

Machine Learning Sessional

Pre-requisite: None

Rationale:

To be oriented different algorithm of machine learning practically to best suit the current need and implement the enhanced learning parameters for maximum performance.

Objective:

1. To implement the appropriate learning algorithm to best suit the current need.
2. To use practical knowledge to enhance the learning parameters to achieve maximum performance and enhance the learning parameters to achieve maximum performance.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Use and apply the appropriate learning algorithm to best suit the current need.
2. Use practical knowledge to enhance the learning parameters to achieve maximum performance.
3. Enhance the learning parameters to achieve maximum performance.

Course Content:

Logistic Regression, Linear Regression; Supervised and Unsupervised learning; Bayesian Learning; Decision Tree Learning; Rule based learning; Instance based learning; Neural Nets; Support Vector Machine; Genetic Algorithms;

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, lab test, quiz, viva.

Assessment Methods & their Weights:

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Use and apply the appropriate learning algorithm to best suit the current need.											√	
Use practical knowledge to enhance the learning parameters to achieve maximum performance.						√						
Enhance the learning parameters to achieve maximum performance.										√		

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Orientation Practical on Logistic Regression Linear Regression;	
2	Lec 4 Lec 5 Lec 6	Implementing Supervised and Unsupervised learning	Assignment
3	Lec 7 Lec 8 Lec 9	Implementing Bayesian Learning Implementing Decision Tree Learning;	Lab Test 1
4	Lec 10 Lec 11 Lec 12	Implementing Rule based learning and Instance based learning;	Assignment
5	Lec 13 Lec 14 Lec 15	Implementing Neural Net	Lab Test 2
6	Lec 16 Lec 17 Lec 18	Implementing Support Vector Machine Implementing Genetic Algorithms	
7	Lec 19 Lec 20 Lec 21	Final Quiz Viva	

CSE-443 **3 hours in a week, 3.00 Cr.**

Pattern Recognition

Pre-requisite: None

Rationale:

This course motivates to recognize patterns, regularities and also irregularities in data by using various pattern recognition algorithms and techniques to find useful information for science, business, organizational decisions as well as contributing to the field of machine learning, data mining and artificial intelligence.

Objective:

1. To provide a comprehensive introduction to pattern recognition techniques leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. To specify sectors and context where the application of pattern recognition can provide a fruitful solution.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Identify areas where pattern recognition techniques can offer a solution.
2. Describe the strength and limitations of some techniques used in pattern recognition for classification, regression and density estimation problems.
3. Conduct, document and present a literature review on a topic related to Machine Learning and Pattern Recognition.
4. Solve problems in regression and classification.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Identify areas where pattern recognition techniques can offer a solution.		√										
2. Describe the strength and limitations of some techniques used in pattern rcognition for classification, regression and density estimation problems.		√										
3. Conduct, document and present a literature review on a topic related to Machine Learning and Pattern Recognition.			√									
4. Sole problems in regression and classification.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Pattern Recognition Importance of Pattern Recognition tatistical and Neural Pattern Recognition	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Review of Probability Distributions Review of Probability Distributions (Contd.) Bayesian classifier	
3	Lec 7 Lec 8 Lec 9	Bayes Decision Theory Discriminate Functions Decision Surfaces	
4	Lec 10 Lec 11 Lec 12	Bayesian Classifier for Normal Distribution Naïve Bayes Classifier Bayesian Belief Networks	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Linear classifiers Discriminate Functions Decision Hyperplanes	
6	Lec 16 Lec 17 Lec 18	Perceptron Algorithm Least Squares Methods Kessler's Construction	
7	Lec 19 Lec 20 Lec 21	Nonlinear Classifier Two and Three Layer Perceptrons Back Propagation Algorithm	

8	Lec 22 Lec 23 Lec 24	Template matching Optimal Path Searching Techniques Optimal Path Searching Techniques (Contd.)	
9	Lec 25 Lec 26 Lec 27	Dynamic Programming Methods (Contd.) Dynamic Programming Methods (Contd.) Correlation Methods	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Context Dependent Classification Observable and Hidden Markov Models Viterbi Algorithm	
11	Lec 28 Lec 29 Lec 30	Problems of HMM Problems of HMM Application of HMM in Speech Recognition	
12	Lec 34 Lec 35 Lec 36	Syntactic Pattern Recognition Syntactic Pattern Recognition (Contd.) Syntactic Pattern Recognition (Contd.)	
13	Lec 37 Lec 38 Lec 39	Clustering Algorithms Clustering Algorithms (Contd.) Clustering Algorithms (Contd.)	**Class Test 4**
14	Lec 40 Lec 41 Lec 42	Support Vector Machine Support Vector Machine (Contd.) Support Vector Machine (Contd.)	

Text and Ref Books:

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

CSE-444 — 1.50 hours in a week, 0.75 Cr.

Pattern Recognition Sessional

Pre-requisite: None

Rationale:

This course motivates to apply various algorithm and techniques - classification, regression, clustering, neural network, decision tree and other estimation techniques which helps to identify different types of pattern in data that can give required solution and suggestions to real-life problems for various applications.

Objective:

1. To achieve a basic idea about designing and developing pattern recognition applications using different algorithm and techniques.
2. To analyze regular/irregular pattern in data in order to find out potentially useful information.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Use practical knowledge to identify areas where pattern recognition techniques can offer a solution.
2. Conduct, document and present a literature review on a topic related to Machine Learning and Pattern Recognition practically.
3. Solve problems in regression and classification.

Course Content :

Bayes Classifier, Perceptron Algorithm, Pocket Algorithm, Edit Distance, Basic Sequential Algorithmic Scheme, K-Means Clustering algorithm, Support Vector Machine, Neural Network, Decision Tree.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, project, quiz, viva, lab test.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12

1. Use practical knowledge to identify areas where pattern recognition techniques can offer a solution.						√						
2. Conduct, document and present a literature review on a topic related to Machine Learning and Pattern Recognition practically.								√				
3. Solve problems in regression and classification.									√			

Lecture Schedule

Week	Lecture	Topics
1	Lec 1	Introduction to MATLAB
	Lec 2	Python Script
	Lec 3	Project Idea Distribution
2	Lec 4	Introduction to MATLAB (Contd.)
	Lec 5	Python Script
	Lec 6	Proect Idea Distribution
3	Lec 7	Project Proposal Presentation
	Lec 8	Project Proposal Presentation (Contd.)
	Lec 9	Project Proposal Presentation (Contd.)
4	Lec 10	Bayes Classifier
	Lec 11	Bayes Classifier (Contd.)
	Lec 12	Home Assignment
5	Lec 13	K-Nearest Neighbour Classification K-Nearest Neighbour
	Lec 14	Classification (Contd.)
	Lec 15	Home Assignment
6	Lec 16	Linear Classifiers
	Lec 17	Linear Classifiers (Contd.)
	Lec 18	Home Assignment
7	Lec 19	Perceptron Algorithm
	Lec 20	Perceptron Algorithm (Contd.)
	Lec 21	Home Assignment
8	Lec 22	Lab Test 1
	Lec 23	Lab Test 1 (Contd.)
	Lec 24	Lab Test 1 (Contd.)
9	Lec 25	Clustering Algorithms
	Lec 26	Clustering Algorithms (Contd.)
	Lec 27	Home Assignment
10	Lec 31	Project Update
	Lec 32	Project Update (Contd.)
	Lec 33	Project Update (Contd.)
11	Lec 28	Support Vector Machine
	Lec 29	Support Vector Machine (Contd.)
	Lec 30	Neural Network

12	Lec 34 Lec 35 Lec 36	Neural Network (Contd.) Decision Tree Decision Tree (Contd.)
13	Lec 37 Lec 38 Lec 39	Quiz Quiz (Contd.) Viva
14	Lec 40 Lec 41 Lec 42	Project Final Submission Project Final Submission (Contd.) Project Final Submission (Contd.)

Text and Ref Books:

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

CSE-445 — 3 hours in a week, 3.00 Cr.

Digital Signal Processing

Pre-requisite: None

Rationale:

This course discusses the concepts of discrete signal processing and their applications in communications, control and instrumentation.

Objective:

1. To understand the key theoretical principles underpinning DSP in a design procedure through design examples and case studies.
2. To learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate Digital Signal Processing systems.
3. To determine the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
4. To design a real-time signal processing algorithms using the latest fixed-point processor.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Explain the key theoretical principles underpinning DSP in a design procedure through this design examples and case study
2. Determine the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
3. Design signal processing algorithms

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Explain the key theoretical principles underpinning DSP in a design procedure through this design examples and case study	√											
Determine the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.		√										
Design signal processing algorithms.					√							

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to speech image & data processing	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Discrete time signals Sequences	
3	Lec 7 Lec 8 Lec 9	Linear Constant Coefficient difference equation	
4	Lec 10 Lec 11 Lec 12	Sampling continuous time signals	
5	Lec 13 Lec 14 Lec 15	Two dimensional sequences and systems	**Class Test 2**
6	Lec 16 Lec 17 Lec 18	Z-transform Inverse Z-transform H-transform	
7	Lec 19 Lec 20 Lec 21	Frequency domain representation Discrete time systems and signals	
8	Lec 22 Lec 23 Lec 24	Fourier series and Fourier Transform	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Parseval's Theorem	
10	Lec 31 Lec 32 Lec 33	Equivalent Bandwidth Noise Convolution	
11	Lec 28 Lec 29 Lec 30	Correlation Numerical integration	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Computation of the DFT	
13	Lec 37 Lec 38 Lec 39	Goertzel FFT Chirp Z-transform algorithms.	

14	Lec 40 Lec 41 Lec 42	Two-dimensional filter design Quantization effects in digital filters.	

Text and Ref Books:

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

CSE-446 — 1.50 hours in a week, 0.75 Cr.

Digital Signal Processing Sessional

Pre-requisite: None

Rationale:

This course helps to better understanding of dealing with signals and processing signals for getting desired output, removing noise associate with signals.

Objective:

1. To design, simulate and implement digital signal processing systems in MATLAB
2. To design and implement a real-time signal processing algorithms using the latest fixed-point processor.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate Digital Signal Processing systems.
2. Determine the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
3. Design a real-time signal processing algorithms using the latest fixed-point processor.

Course Content:

Speech, image & data processing algorithms; Sampling continuous time signals; Z-transform, Inverse Z-transform, Frequency domain representation, Fourier series and Fourier Transform; Equivalent noise definition of bandwidth; Convolution, Correlation and method of numerical integration; Computation of the DFT: Goertzel FFT, Chirp Z-transform algorithms. Two-dimensional filter design.

Teaching-learning and Assessment Strategy:

Lectures, class performances, lab test, quiz, viva.

Assessment Methods & their Weights:

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Learn how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate Digital Signal Processing systems.									√			
Determine the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.							√					
Design a real-time signal processing algorithms using the latest fixed-point processor.									√			

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1-2	Lec 1 Lec 2 Lec 3	Orientation Implementing signal processing algorithm	

3-4	Lec 4 Lec 5 Lec 6	Sampling continuous time signals	Assignment on sampling
5-6	Lec 7 Lec 8 Lec 9	Implementing Z-transform, Inverse Z-transform	
7-8	Lec 10 Lec 11 Lec 12	Problem solving on noise removal using bandwidth	
9-10	Lec 13 Lec 14 Lec 15	Fourier Transformation of signals Assignment: Chirp Z-transform algorithms	
11-12	Lec 16 Lec 17 Lec 18	Lab Test	
13-14	Lec 19 Lec 20 Lec 21	Quiz Viva	

CSE-449 — 3 hours in a week, 3.00 Cr.

Mobile and Ubiquitous Computing

Pre-requisite: None

Rationale:

This course motivates to enable computing technologies in such a way where computing is allowed to appear anytime and everywhere by studying affordances, limitations, necessary protocols, user interfaces, framework design etc. of such computing systems in order to implement them for different applications.

Objective:

1. To identify different features that helps to develop a mobile, personalized and context independent computing system.
2. To analyze the different properties and requirements that influences the development of a mobile and ubiquitous computing system.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Describe mobile wireless communication technologies and explain their functioning.
2. Explain the fundamental trade-offs related to resource limitations and communication needs in mobile communication and sensing systems.
3. Demonstrate an understanding of the range of novel applications based upon mobile systems as well as their particular requirements

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Describe mobile wireless communication technologies and explain their functioning.	√											
Explain the fundamental trade-offs related to resource limitations and communication needs in mobile communication and sensing systems.		√										
Demonstrate an understanding of the range of novel applications based upon mobile systems as well as their particular requirements.	√											

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction Evolution of Mobile Computing Systems Affordances of Mobile Systems	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Constraints of the Mobile Platform Network Protocol for Wireless Networks Transport Protocol for Wireless Networks	
3	Lec 7 Lec 8 Lec 9	Mobile IP Variants of TCP Distributed Platforms for Mobile Computing	
4	Lec 10 Lec 11 Lec 12	Proxy Based Architectures Service Discovery Interaction Platforms	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	File System Support for Mobile Computing Development of Context Aware Computing Development of Ubiquitous Computing	
6	Lec 16 Lec 17 Lec 18	Smart Embedded Device Information Appliance Wearable Computers	
7	Lec 19 Lec 20 Lec 21	Sensing Acquisition Context Acquisition Proximity Based Networking	
8	Lec 22 Lec 23 Lec 24	Proximity Based Networking (Contd.) Communication Protocol for Wireless Sensor Network Human Interaction in Ubiquitous Computing Environment	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Tangible User Interfaces Privacy and Security Privacy and Security (Contd.)	
10	Lec 31 Lec 32 Lec 33	Components of LBS-WAP Components of GPS Cell-based Location Service	
11	Lec 28 Lec 29 Lec 30	3G Wireless VXML SMS-MMS	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Personal Area Network 802.11 and Bluetooth IRFIDs	

13	Lec 37 Lec 38 Lec 39	Micro-electro-mechanical (MEMES) Android Framework Android Application Structure	
14	Lec 40 Lec 41 Lec 42	Recommender System Collaborative Filtering Intelligent Agents	

Text and Ref Books:

1. Context-Aware Mobile and Ubiquitous Computing for Enhanced Usability: Adaptive Technologies and Applications (1st Edition) –Dragan Stojanovic; Information Science Reference (2009)
2. Fundamentals of Mobile and Pervasive Computing (1st Edition) - Frank Adelstein,

   Sandeep KS Gupta, Golden Richard III and Loren Schwiebert; McGraw-Hill (2004)

   3. Handbook on Mobile and Ubiquitous Computing: Status and Perspective (1st Edition) - Laurence T. Yang, EviS Yukur and Seng W. Loke; CRC Press (2013)

CSE-450 1.50 hours in a week, 0.75 Cr.

Mobile and Ubiquitous Computing Sessional

Pre-requisite: None

Rationale:

This course motivates to use mobile communication and sensing systems based on devices which are equipped with sensors that enable the inference of the surrounding context, including the position, activity, and the environment of the user and emphasize on developing deeper understanding of the functioning of mobile wireless networks, mobile sensing, pervasive computing and applications of mobile systems.

Objective:

1. To demonstrate understanding of the technical, commercial and social issues relating to ubiquitous communications and the basics of wireless communications.
2. To develop simple wireless web applications.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Demonstrate practical skills in developing mobile sensing applications.
2. Design and create mobile application in team base with presentation.
3. Explain the range of novel applications based upon mobile systems as well as their particular requirements.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, viva, quiz, project.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Demonstrate practical skills in developing mobile sensing applications.						√						
2. Design and create mobile application in team base with presentation.									√			
3. Explain the range of novel applications based upon mobile systems as well as their particular requirements.							√					

Lecture Schedule

Week	Lecture	Topics
1	Lec 1 Lec 2 Lec 3	Introduction to Mobile and Ubiquitous Computing Affordances of Mobile Systems Constraints of Mobile Platform
2	Lec 4 Lec 5 Lec 6	Wireless Fundamentals Introduction to Mobile OS - iOS, Android Android Programming
3	Lec 7 Lec 8 Lec 9	Discussion of Project Proposal Discussion of Project Proposal (Contd.) Discussion of Project Proposal (Contd.)
4	Lec 10 Lec 11 Lec 12	Android Programming - Android Framework Android Application Structure
5	Lec 13 Lec 14 Lec 15	UI components and Layouts Notification Manager and Listeners Home Assignment
6	Lec 16 Lec 17 Lec 18	Presentation on the project proposal Presentation on the project proposal Submission of a report
7	Lec 19 Lec 20 Lec 21	Local- Area Wireless Interfaces on Smartphones Details of IEEE 802.11 and Bluetooth Lab Assignment
8	Lec 22 Lec 23 Lec 24	Mobile Sensing Strategies Mobile Sensing Strategies (Contd.) Home Assignment
9	Lec 25 Lec 26 Lec 27	Show Project Update Show Project Update (Contd.) Show Project Update (Contd.)
10	Lec 31 Lec 32 Lec 33	Sensor Sampling Best Practices in Sensing Sensing position, Activity, Environment.
11	Lec 28 Lec 29 Lec 30	Communication Management in Android Java Sockets Data transfer with Android
12	Lec 34 Lec 35 Lec 36	Show Project Update Show Project Update (Contd.) Show Project Update (Contd.)
13	Lec 37 Lec 38 Lec 39	Wireless Traffic Analysis from Large Scale Data sets Call Data Record Home Assignment: Case Study
14	Lec 40	Viva

	Lec 41 Lec 42	Submission of Final Project Project Presentation

Text and Ref Books:

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

CSE-451 3 hours in a week, 3.00 Cr.

Simulation and Modeling

Pre-requisite: None

Rationale:

This course motivates to enable a substitute of physical experimentation that is often utilized when conducting experiments on a real system which is impossible or impractical, often because of cost or time and instead uses mathematical knowledge and computer's computation power to solve real-world problems reasonably and in a time efficient manner.

Objective:

1. To recognize different parameters and variables that affects a system's simulation.
2. To design a model for a particular dataset and analyze a system's behaviour for real life problems.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Define basic concepts in modeling and simulation (M&S).
2. Classify various simulation models and give practical examples for each category.
3. Construct a model for a given set of data and motivate its validity.

Course Content :

Simulation modeling basics: systems, models and simulation; Classification of simulation model; Steps in a simulation study; Concepts in discrete-event simulation: event scheduling vs. process interaction approaches, Time-advance mechanism, organization of a discrete-event simulation model; continuous simulation models; Combined discrete-continuous models; Monte Carlo simulation; Simulation of queuing systems. Building valid and credible simulation models: validation principles and techniques, statistical procedures (or comparing real-world observations and simulation outputs, input modeling; Generating random numbers and random variants; Output analysis. Simulation languages; Analysis and modeling of some practical systems, Random Number Generator, Random Variables, Probability Distribution.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Define basic concepts in modeling and simulation (M&S).	√											
2. Classify various simulation models and give practical examples for each category.		√										
3. Construct a model for a given set of data and motivate its validity.			√									

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Simulation Applications of Simulation System and System Environment	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Attributes of a System Types of Models Components and Organization of a Discrete Event Simulation Model	
3	Lec 7 Lec 8 Lec 9	Single Server Queuing System Performance Measure Event Routines	
4	Lec 10 Lec 11 Lec 12	Review Of Basic Probability And Statistics PDF And CDF Properties Of Random Variables	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Covariance and Correlation Jointly Continuous Random Variables Simulation of Inventory System	

6	Lec 16 Lec 17 Lec 18	Continuous Simulation Predator-Prey Model Useful Probability Distributions	
7	Lec 19 Lec 20 Lec 21	Parameterization of Continuous Distributions Continuous Probability Distribution Continuous Probability Distribution (Contd.)	
8	Lec 22 Lec 23 Lec 24	Discrete Probability Distribution Discrete Probability Distribution (Contd.) Monte Carlo Simulation	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Monte Carlo Simulation (Contd.) Generating Random Variables Random Variable Method: Inverse Transform	
10	Lec 31 Lec 32 Lec 33	Random Variable Method: Composition Random Variable Method: Convolution Random Variable Method: Acceptance -Rejection	
11	Lec 28 Lec 29 Lec 30	Random Variable Method: Acceptance -Rejection (Contd.) Mathematical Problems For Inverse Method Generating Random Variates	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Acceptance-Rejection Method For Generating Random Variates Sample Variance And Mean Central Limit Theorem	
13	Lec 37 Lec 38 Lec 39	Mathematical Problems of Central Limit Theorem Confidence Interval Test of Hypothesis And its Error	
14	Lec 40 Lec 41 Lec 42	Markov's Inequality and Chebyshev's Inequality Combined Discrete-Continuous Simulation Validation and Verification Of Simulation Model	

Text and Ref Books:

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

CSE-452 **1.50 hours in a week, 0.75 Cr.**

Simulation and Modeling Sessional

Pre-requisite: None

Rationale:

This course motivates to design various models to solve real-world problems using mathematics, computer programming language, computation power etc. and analyze the behaviour of a system for different types of dataset to provide a reasonable decision regarding the performance of a system in a cost and time effective manner.

Objective:

1. To design a model for a physical experimentation using different programming languages on different platforms.
2. To analyze the the characteristics of the simulation result basing on different sets of data and test its validity.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Generate and test random number variants and apply them to develop simulation models.
2. Select and analyze output data produced by a model and test the validity of the model.
3. Construct a model for a given set of data and motivate its validity.

Course Content :

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, lab test, quiz, viva.

Assessment Methods & their Weights:

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Generate and test random number variants and apply them to develop simulation models.										√		
2. Select and analyze output data produced by a model and test the validity of the model.											√	
3. Construct a model for a given set of data and motivate its validity.									√			

Lecture Schedule

Week	Lecture	Topics	Remarks
1	Lec 1 Lec 2 Lec 3	Simulation Modeling Basics Systems, Models and Simulation Types Sequence of Simulation Study	
2	Lec 4 Lec 5 Lec 6	Single Server Queuing System Lab Assignment Home Assignment	
3	Lec 7 Lec 8 Lec 9	Single Server Queuing System (Contd.) Lab Assignment Home Assignment	
4	Lec 10 Lec 11 Lec 12	Inventory Management System Lab Assignment Home Assignment	
5	Lec 13 Lec 14 Lec 15	Inventory Management System (Contd.) Lab Assignment Home Assignment	
6	Lec 16 Lec 17 Lec 18	Monte Carlo Method Lab Assignment Home Assignment	
7	Lec 19 Lec 20 Lec 21	Monte Carlo Method (Contd.) Lab Assignment Home Assignment	
8	Lec 22 Lec 23 Lec 24	Pure Pursuit Problem Lab Assignment Home Assignment	
9	Lec 25 Lec 26	Pure Pursuit Problem (Contd.) Lab Assignment	

	Lec 27	Home Assignment	
10	Lec 31 Lec 32 Lec 33	Probability Distribution Fitting Lab Assignment Home Assignment	
11	Lec 28 Lec 29 Lec 30	Probability Distribution Fitting (Contd.) Lab Assignment Home Assignment	
12	Lec 34 Lec 35 Lec 36	Random Number Generation Lab Assignment Home Assignment	
13	Lec 37 Lec 38 Lec 39	Hypothesis Testing Lab Assignment Home Assignment	
14	Lec 40 Lec 41 Lec 42	Lab Test Quiz Viva	

Text and Ref Books:

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

CSE-453

Data Ware-housing and Data Mining 3 hours in a week, 3.00 Cr.

Pre-requisite: NONE

Rationale:

For better data analysis, visualization and decision making concepts of data ware housing and data mining plays vital role.

Objective:

1. To evaluate accuracy of models/ algorithms, discover and measure interesting patterns from different kinds of databases of clustering, classification, association finding, feature selection and visualization to real world data.
2. To identify problems profitably be addressed via data mining methods.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Decide and evaluate models/ algorithms with respect to their accuracy.
2. Discover and measure interesting patterns from different kinds of databases. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.
3. Learn to identify problems that can profitably be addressed via data mining methods.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Decide and evaluate models/ algorithms with respect to their accuracy		√										
Discover and measure interesting patterns from different kinds of databases. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data.			√									
Learn to identify problems that can profitably be addressed via data mining methods.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction	
2	Lec 4 Lec 5	Data warehousing and OLAP technology for data mining	**Class Test 1**

	Lec 6		
3	Lec 7 Lec 8 Lec 9	Data preprocessing	
4	Lec 10 Lec 11 Lec 12	Data mining primitives, languages and systems	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Data Visualization Techniques	
6	Lec 16 Lec 17 Lec 18	Data Cube computation	
7	Lec 19 Lec 20 Lec 21	Multidimensional data analysis	
8	Lec 22 Lec 23 Lec 24	Descriptive Data mining	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Characterization and comparison	
10	Lec 31 Lec 32 Lec 33	Association analysis	
11	Lec 28 Lec 29 Lec 30	Classification and prediction	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Cluster analysis	
13	Lec 37 Lec 38 Lec 39	Mining complex types of data	
14	Lec 40 Lec 41 Lec 42	Applications and trends in data mining	

Text and Ref Books:

1. Data Mining: Concepts and Techniques - Jiawei Han, MichelineKamber, and Jian Pei, (Morgan Kaufmann)

2. Data Mining and Data Warehousing - Bharat BhushanAgarwal, SumitPrakashTayal
3. Data Warehousing, Data Mining, and OLAP - Alex Berson and Stephen J. Smith

CSE-454 — 1.50 hours in a week, 0.75 Cr.

Data Ware-housing and Data Mining Sessional

Pre-requisite: None

Rationale:

Implementing data analysis methods, visualization and decision making concepts of data ware housing and data mining.

Objective:

1. Gain a working knowledge of the strengths and limitations of modern data mining methods (algorithms).
2. Learn to identify problems that can profitably be addressed via data mining methods.
3. Learn how to set up data for data mining experiments.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Gain a working knowledge of the strengths and limitations of modern data mining methods (algorithms).
2. Learn to identify problems that can profitably be addressed via data mining methods.
3. Learn how to set up data for data mining experiments.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, lab tests, quiz, viva.

Assessment Methods & their Weights:

Category	Marks %
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
Gain a working knowledge of the strengths and limitations of modern data mining methods (algorithms).	√											
Learn to identify problems that can profitably be addressed via data mining methods.		√										
Learn how to set up data for data mining experiments.			√									

Lecture Schedule

Week	Lecture	Topics	Remarks
1-2	Lec 1 Lec 2 Lec 3	Orientation lab Practical on Data warehousing	
3-4	Lec 4 Lec 5 Lec 6	Implementing Data preprocessing techniques	Assignment
5-6	Lec 7 Lec 8 Lec 9	Implementing Data visualization techniques Implementing association analysis	Assignment
7-8	Lec 10	Practice on Classification and prediction;	Lab Test 1

	Lec 11 Lec 12		
9-10	Lec 13 Lec 14 Lec 15	Practice on Cluster analysis	Assignment
11-12	Lec 16 Lec 17 Lec 18	Final Lab Test	
13-14	Lec 19 Lec 20 Lec 21	Final Quiz Viva	

CSE-455 — 3 hours in a week, 3.00 Cr.

Natural Language Processing

Pre-requisite:

Rationale:

NLP introduces the basics of statistical natural language processing (NLP) including both linguistics concepts such as morphology and syntax and machine learning techniques relevant for NLP. This course provides a comprehensive introduction to the theory and practice of text-based natural language processing (NLP)—the development of computer programs that can understand, generate, translate, extract information from, and learn natural language in textual form from web pages, books, newspapers, etc.

Objective:

1. To understand natural language processing and to learn how to apply basic techniques for text-based processing of natural language.
2. To understanding approaches to syntax and semantics in NLP.
3. To Understand current methods for statistical approaches to machine learning techniques used in NLP.
4. To implement the NLP technique in different application

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Develop the knowledge on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.
2. Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.
3. Enable to implement the NLP technique in different application

Course Content:

Intro to NLP and Deep Learning; Simple Word Vector representations: word2vec, GloVe; Advanced word vector representations: language models, softmax, single layer networks; Neural Networks and backpropagation for named entity recognition; Neural Networks and Back-Prop; gradient checks, overfitting, regularization, activation functions; Introduction to Tensorflow; Recurrent neural networks - for language modeling and other tasks; GRUs and LSTMs -- for machine translation; Recursive neural networks -- for parsing; Recursive neural networks -- for different tasks (e.g. sentiment analysis); Convolutional neural networks -- for sentence classification; Speech recognition; Machine Translation; Seq2Seq and Large Scale DL; Deep Learning for NLP: Dynamic Memory Networks.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Develop the knowledge on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.	√											
2. Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.		√										
3. Enable to implement the NLP technique in different application					√							

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Intro to NLP and Deep Learning; Simple Word Vector representations: word2vec, GloVe;	
2	Lec 4 Lec 5 Lec 6	Advanced word vector representations: language models, softmax, single layer networks;	
3	Lec 7 Lec 8 Lec 9	Neural Networks and backpropagation for named entity recognition	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Neural Networks and Back-Prop, gradient checks, overfitting, regularization, activation functions	
5	Lec 13 Lec 14 Lec 15	Recurrent neural networks - for language modeling and other tasks	
6	Lec 16 Lec 17 Lec 18	GRUs and LSTMs -- for machine translation	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Recursive neural networks -- for parsing	
8	Lec 22 Lec 23 Lec 24	Recursive neural networks -- for different tasks (e.g. sentiment analysis)	
9	Lec 25 Lec 26 Lec 27	Convolutional neural networks -- for sentence classification	**Class Test 3**
10	Lec 31 Lec 32 Lec 33	Convolutional neural networks -- for sentence classification	
11	Lec 28 Lec 29 Lec 30	Speech recognition; Machine Translation; Seq2Seq and Large Scale DL;	
12	Lec 34 Lec 35 Lec 36	Speech recognition; Machine Translation; Seq2Seq and Large Scale DL;	
13	Lec 37 Lec 38 Lec 39	Deep Learning for NLP: Dynamic Memory Networks.	**Class Test 4**

14	Lec 40 Lec 41 Lec 42	Deep Learning for NLP: Dynamic Memory Networks.	

Text and Ref Books:

1. A Primer on Neural Network Models for Natural Language Processing - Yoav Goldberg; Morgan & Claypool Publishers (2017)

CSE-456 1.50 hours in a week, 0.75 Cr.

Natural Language Processing Sessional

Pre-requisite: None

Rationale:

This course covers a wide range of tasks in Natural Language Processing from basic to advanced: sentiment analysis, summarization, dialogue state tracking. It enables to recognize NLP tasks in day-to-day work, propose approaches, and judge what techniques are likely to work well. The final project is devoted to one of the most remarkable topics in today's NLP

Objective:

1. To develop the skill natural language processing and to learn how to apply basic techniques for text-based processing of natural language.
2. To familiarize approaches to syntax and semantics in NLP.
3. To implement current methods for statistical approaches to machine learning techniques used in NLP.
4. To implement the NLP technique in different application

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Develop the skill on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.
2. Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.
3. Enable to implement the NLP technique in different application

Course Content:

Language models, softmax, single layer networks; Neural Networks and backpropagation for named entity recognition; Tensorflow; Recurrent neural networks - for language modeling and other tasks; GRUs and LSTMs -- for machine translation; Recursive neural networks -- for parsing; Convolutional neural networks -- for sentence classification; Speech recognition;

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, lab tests, final quiz, viva.

Assessment Methods & their Weights:

Category	**Marks %**
Lab test	40
Quiz	20
Viva	10
Class Performance	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
Develop the skill on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.									√			
Familiarize with the current methods for statistical approaches to mach ne learning techniques used in NLP.							√					
Enable to implement the NLP technique in different application						√						

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1-2	Lec 1 Lec 2 Lec 3	Practical session on language models and softmax, single layer networks;	

3-4	Lec 4 Lec 5 Lec 6	Practical session on Neural Networks and backpropagation for named entity recognition;	Assignment
5-6	Lec 7 Lec 8 Lec 9	Understanding workflow of Tensorflow Practical session on Recurrent neural networks for language modeling and other tasks;	Lab Test 1
7-8	Lec 10 Lec 11 Lec 12	Practical session on GRUs and LSTMs for machine translation	Assignment
9-10	Lec 13 Lec 14 Lec 15	Practical session on Recursive neural networks for parsing	Assignment
11-12	Lec 16 Lec 17 Lec 18	Practical session on Convolutional neural networks for sentence classification; Speech recognition	Lab Test 2
13-14	Lec 19 Lec 20 Lec 21	Final quiz Viva	

CSE-457 — 3 hours in a week, 3.00 Cr.

Advanced Database Systems

Pre-requisite: None

Rationale:

This course motivates to optimize the basic database transactions, query processing, concurrency control and other functions of database systems using advanced features that includes complex data and also assess various database models and designs to contribute to modern database systems.

Objective:

1. To introduce the concepts and implementation schemes in database management systems such as advanced access methods, query processing and optimization, transactions and concurrency control.
2. To analyze and evaluate different models and methods of database systems for certain context using complex data and functions.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Explain and evaluate the fundamental theories and requirements that influence the design of modern database systems.
2. Assess and apply database functions and packages suitable for enterprise database development and database management.
3. Critically evaluate alternative designs and architectures for databases and data warehouses.
4. Discuss and evaluate methods of storing, managing and interrogating complex data.

Course Content :

Object oriented database; data model, design, languages; object relational database: complex data types, querying with complex data types, design; distributed database: levels of distribution transparency, translation of global queries to fragment queries, optimization of access strategies, management of distributed transactions, concurrency control, reliability, administration; Parallel Database: different types of parallelism, design of parallel database; multimedia database systems basic concepts, design, optimization of access strategies, management of multimedia database systems, reliability; database warehousing/ data mining: basic concepts and algorithms.

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, class tests, final exam.

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	Program Outcome (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Explain and evaluate the fundamental theories and requirements that influence the design of modern database systems.		√										
2. Assess and apply database functions and packages suitable for enterprise database development and database management.			√									
3. Critically evaluate alternative designs and architectures for databases and data warehouses.		√										
4.Discuss and evaluate methods of storing, managing and interrogating complex data.		√										

Lecture Schedule

Week	Lecture	Topics	Class Test
1	Lec 1 Lec 2 Lec 3	Introduction to Database Systems Applications of Database Systems Database Systems over File Systems	**Class Test 1**
2	Lec 4 Lec 5 Lec 6	Types of Database Data Model Design Data Languages	
3	Lec 7 Lec 8 Lec 9	Object Oriented Database Object Oriented Data Model Object Oriented Data Languages and Query	
4	Lec 10 Lec 11 Lec 12	Object Relational Database Querying with Complex Data Types Design with Complex Data Types	**Class Test 2**
5	Lec 13 Lec 14 Lec 15	Distributed Database Levels of Distribution Transparency Query Processing	
6	Lec 16 Lec 17 Lec 18	Translation of Global Queries to Fragment Queries Optimization of Access Strategies Optimization of Access Strategies (Contd.)	
7	Lec 19 Lec 20 Lec 21	Transaction Processing Different Types of Transactions Different Types of Transactions (Contd.)	
8	Lec 22 Lec 23 Lec 24	Management of Distributed Transactions Concurrency Control Concurrency Control (Contd.)	**Class Test 3**
9	Lec 25 Lec 26 Lec 27	Reliability Administration Parallel Database	
10	Lec 31 Lec 32 Lec 33	Different Types of Parallelism Different Types of Parallelism (Contd.) Design of Parallel Database	
11	Lec 28 Lec 29 Lec 30	Multimedia Database System Basic Concepts and Design Optimization of Access Strategies	**Class Test 4**
12	Lec 34 Lec 35 Lec 36	Management of Multimedia Database Systems Reliability Administration	
13	Lec 37 Lec 38 Lec 39	Database Warehousing Types of Database Warehouse OLTP and OLAP	

14	Lec 40 Lec 41 Lec 42	Data Mining Basic Concepts and Algorithms Basic Concepts and Algorithms (Contd.)	

Text and Ref Books:

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

CSE-458 1.50 hours in a week, 0.75 Cr.

Advanced Database Systems Sessional

Pre-requisite: None

Rationale:

This course motivates to design and develop embedded projects using advanced database functions and query based on advanced database models - object oriented database, distributed database, multimedia database etc. to solve real-life problems.

Objective:

1. To develop embedded projects for different applications using advanced database functions.
2. To analyze different security aspects of complex data transactions using different database techniques.

Course Outcomes (CO):

Upon completion of the course, the students will be able to:

1. Solve and apply the advanced knowledge in different projects with a commercial relational database system (Oracle).
2. Embed security aspects in the developed systems aspects of data transaction.
3. Explain the methods of storing, managing and interrogating complex data.

Course Content:

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

Teaching-learning and Assessment Strategy:

Lectures, class performances, assignments, presentation, project, quiz, viva.

Assessment Methods & their Weights:

Category	**Marks %**
Project	40
Quiz	20
Viva / Presentation	10
Class Participation	10
Report	10
Class Assessment	10
Total	**100**

Mapping of Course Outcomes (CO) and Program Outcomes:

Course Outcomes(CO) of the Course	**Program Outcome (PO)**											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Solve and apply the advanced knowledge in different projects with a commercial relational database system (Oracle).											√	
2. Embed security aspects in the developed systems aspects of data transaction.						√						
3. Explain the methods of storing, managing and interrogating complex data.							√					

Lecture Schedule

Week	**Lecture**	**Topics**	**Remarks**
1	Lec 1	Introduction to Oracle Installation	
	Lec 2	Introduction to Oracle Installation (Contd.)	
	Lec 3	Lab Assignment	
2	Lec 4	Basic SQL Query: Data Expressions	
	Lec 5	Lab Assignment	
	Lec 6	Home Assignment	
3	Lec 7	Advanced SQL Query and Sub-Query	
	Lec 8	Lab Assignment	

	Lec 9	Home Assignment	
4	Lec 10 Lec 11 Lec 12	Advanced SQL Query and Sub-query (Contd.) Lab Assignment Home Assignment	
5	Lec 13 Lec 14 Lec 15	Constraints Lab Assignment Home Assignment	
6	Lec 16 Lec 17 Lec 18	Presentation on the project proposal Presentation on the project proposal Submission of a report	
7	Lec 19 Lec 20 Lec 21	Authentication and Security Lab Assignment Home Assignment	
8	Lec 22 Lec 23 Lec 24	Submission of the E- R diagram Submission of Schema diagram Show Project Update	
9	Lec 25 Lec 26 Lec 27	Introduction to PL Packages Introduction to PL Packages (Contd.) Lab Assignment	
10	Lec 31 Lec 32 Lec 33	Indexing Hashing Lab Assignment	
11	Lec 28 Lec 29 Lec 30	Presentation of Back End (SQL) Presentation of Back End (SQL) Report Submission	
12	Lec 34 Lec 35 Lec 36	Show Project Update Show Project Update (Contd.) Show Project Update (Contd.)	
13	Lec 37 Lec 38 Lec 39	Introduction to Database Trigger/Procedure Lab Assignment Home Assignment	
14	Lec 40 Lec 41 Lec 42	Viva Submission of Final Project Project Presentation	

Text and Ref Books:

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

APPENDIX A

EQUIVALENCE TABLE

	Old Course (2018-2020)				New Course (2019-2021)		
Ser.	**Course No.**	**Course Title**	**Cr.**		**Course No.**	**Course Title**	**Cr.**
1.	CSE-100	Introduction to Computer Systems Sessional	1.50		CSE-100	Introduction to Computer Systems Sessional	1.50
2.	EECE-163	Electrical Circuit Analysis	3.00		EECE-163	Electrical Circuit Analysis	3.00
3.	EECE-164	Electrical Circuit Analysis Sessional	1.50		EECE-164	Electrical Circuit Analysis Sessional	1.50
4.	ME-181	Basic Mechanical Engineering	2.00		ME-181	Basic Mechanical Engineering	2.00
5.	MATH-141	Mathematics-I (Differential Calculus and Integral Calculus)	3.00		MATH-141	Mathematics-I (Differential Calculus and Integral Calculus)	3.00
6.	PHY-103	Physics	3.00		PHY-103	Physics	3.00
7.	PHY-104	Physics Sessional	0.75		PHY-104	Physics Sessional	0.75
8.	HUM-101	English	2.00		HUM-101	Developing English Language Skills I	2.00
9.	Shop-140	Workshop Practice Sessional	0.75		Shop-140	Workshop Practice Sessional	0.75
10.	CSE-101	Discrete Mathematics	3.00		CSE-101	Discrete Mathematics	3.00
11.	CSE-105	Structured Programming Language	3.00		CSE-105	Structured Programming Language	3.00
12.	CSE-106	Structured Programming Language Sessional	1.50		CSE-106	Structured Programming Language Sessional	1.50
13.	EECE-169	Electronic Devices and Circuits	3.00		EECE-169	Electronic Devices and Circuits	3.00
14.	EECE-170	Electronic Devices and Circuits Sessional	1.50		EECE-170	Electronic Devices and Circuits Sessional	1.50
15.	CE-150	Engineering Drawing & CAD Sessional	1.50		CE-150	Engineering Drawing & CAD Sessional	1.50
16.	CHEM-101	Chemistry	3.00		CHEM-101	Chemistry	3.00
17.	MATH-143	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.00		MATH-143	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.00
18.	CSE-201	Digital Logic Design	3.00		CSE-201	Digital Logic Design	3.00
19.	CSE-202	Digital Logic Design Sessional	1.50		CSE-202	Digital Logic Design Sessional	1.50
20.	CSE-203	Data Structures and Algorithms-I	3.00		CSE-203	Data Structures and Algorithms-I	3.00

	Old Course (2018-2020)				New Course (2019-2021)		
Ser.	**Course No.**	**Course Title**	**Cr.**		**Course No.**	**Course Title**	**Cr.**
21.	CSE-204	Data Structures and Algorithms-I Sessional	1.50		CSE-204	Data Structures and Algorithms-I Sessional	1.50
22.	CSE-205	Object Oriented Programming Language	3.00		CSE-205	Object Oriented Programming Language	3.00
23.	CSE-206	Object Oriented Programming Language Sessional-I	1.50		CSE-206	Object Oriented Programming Language Sessional-I	1.50
24.	EECE-269	Electrical Drives and Instrumentation	3.00		EECE-269	Electrical Drives and Instrumentation	3.00
25.	EECE-270	Electrical Drives and Instrumentation Sessional	0.75		EECE-270	Electrical Drives and Instrumentation Sessional	0.75
26.	MATH-245	Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)	3.00		MATH-245	Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)	3.00
27.	CSE-211	Digital Electronics and Pulse Technique	3.00		CSE-211	Digital Electronics and Pulse Technique	3.00
28.	CSE-212	Digital Electronics and Pulse Technique Sessional	0.75		CSE-212	Digital Electronics and Pulse Technique Sessional	0.75
29.	CSE-323	Computer Architecture	3.00		CSE-323	Computer Architecture	3.00
30.	CSE-215	Data Structures and Algorithms-II	3.00		CSE-215	Data Structures and Algorithms-II	3.00
31.	CSE-216	Data Structures and Algorithms-II Sessional	1.50		CSE-216	Data Structures and Algorithms-II Sessional	1.50
32.	CSE-217	Theory of Computation	3.00		CSE-217	Theory of Computation	3.00
33.	CSE-220	Object Oriented Programming language Sessional-II	1.50		CSE-220	Object Oriented Programming language Sessional-II	1.50
34.	CSE-224	Advanced Programming Language Sessional	0.75		CSE-224	Advanced Programming Language Sessional	0.75
35.	MATH-247	Mathematics-IV (Complex Variable, Laplace Transform and Statistics)	3.00		MATH-247	Mathematics-IV (Complex Variable, Laplace Transform and Statistics)	3.00
36.	CSE-301	Database Management Systems	3.00		CSE-301	Database Management Systems	3.00
37.	CSE-302	Database Management Systems Sessional	1.50		CSE-302	Database Management Systems Sessional	1.50
38.	CSE-305	Microprocessors, Micro-controllers and Assembly Language	4.00		CSE-305	Microprocessors, Micro-controllers and Assembly Language	4.00
39.	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.50		CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.50
40.	CSE-307	Operating System	3.00		CSE-307	Operating System	3.00
41.	CSE-308	Operating System Sessional	0.75		CSE-308	Operating System Sessional	0.75

	Old Course (2018-2020)				New Course (2019-2021)		
Ser.	**Course No.**	**Course Title**	**Cr.**		**Course No.**	**Course Title**	**Cr.**
42.	CSE-214	Numerical Methods Sessional	1.50		CSE-214	Numerical Methods Sessional	1.50
43.	CSE-317	Data Communication	3.00		CSE-317	Data Communication	3.00
44.	CSE-318	Data Communication Sessional	0.75		CSE-318	Data Communication Sessional	0.75
45.	CSE-303	Compiler	3.00		CSE-303	Compiler	3.00
46.	CSE-304	Compiler Sessional	0.75		CSE-304	Compiler Sessional	0.75
47.	CSE-313	Mathematical Analysis for Computer Science	3.00		CSE-313	Mathematical Analysis for Computer Science	3.00
48.	CSE-315	Digital System Design	3.00		CSE-315	Digital System Design	3.00
49.	CSE-316	Digital System Design Sessional	0.75		CSE-316	Digital System Design Sessional	0.75
50.	CSE-309	Computer Network	3.00		CSE-309	Computer Network	3.00
51.	CSE-310	Computer Network Sessional	1.50		CSE-310	Computer Network Sessional	1.50
52.	CSE-319	Software Engineering	3.00		CSE-319	Software Engineering	3.00
53.	CSE-322	Software Development Sessional	1.50		-	-	-
54.	-	-	-		CSE-360	Integrated Design Project /Capstone Project – I	1.50
55.	HUM-237	Engineering Economics	2.00		HUM-237	Engineering Economics	2.00
56.					HUM-241	Bangladesh Studies	2.00
57.					HUM-243	Sociology	2.00
58.	HUM-102	English Sessional	1.50		HUM-102	Developing English Language Skills II	1.50
59.	CSE-350	Industrial Training	1.00		CSE-350	Industrial Training	1.00
60.	CSE-400	Project or Thesis	6.00		-	-	-
61.	-	-	-		CSE-400	Thesis	4.50
62.	CSE-401	Information System Design and Development	3.00		CSE-401	Information System Design and Development	3.00
63.	CSE-402	Information System Design and Development Sessional	0.75		CSE-402	Information System Design and Development Sessional	0.75
64.	CSE-406	Computer Interfacing Sessional	0.75		-	-	-
65.	CSE- 410	Software Development for Web Apps	0.75		-	-	-
66.	-	-	-		CSE-460	Integrated Design Project /Capstone Project – II	3.00
67.	CSE-403	Artificial Intelligence	3.00		CSE-403	Artificial Intelligence	3.00
68.	CSE-404	Artificial Intelligence Sessional	0.75		CSE-404	Artificial Intelligence Sessional	0.75
69.	CSE-405	Computer Interfacing	3.00		CSE-405	Computer Interfacing	3.00
70.	CSE-415	Human Computer Interaction	3.00		CSE-415	Human Computer Interaction	3.00
71.	CSE-416	Human Computer Interaction Sessional	0.75		CSE-416	Human Computer Interaction Sessional	0.75
72.	CSE-407	Applied Statistics and Queuing Theory	3.00		CSE-407	Applied Statistics and Queuing Theory	3.00

	Old Course (2018-2020)				New Course (2019-2021)		
Ser.	Course No.	Course Title	Cr.		Course No.	Course Title	Cr.
73.	CSE-419	Advanced Algorithms	3.00		CSE-419	Advanced Algorithms	3.00
74.	CSE-421	Basic Graph Theory	3.00		CSE-421	Basic Graph Theory	3.00
75.	CSE-423	Fault Tolerant System	3.00		CSE-423	Fault Tolerant System	3.00
76.	CSE-425	Basic Multimedia Theory	3.00		CSE-425	Basic Multimedia Theory	3.00
77.	CSE-427	Digital Image Processing	3.00		CSE-427	Digital Image Processing	3.00
78.	CSE-431	Object Oriented Software Engineering	3.00		CSE-431	Object Oriented Software Engineering	3.00
79.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00		CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00
80.	CSE-435	Distributed Algorithms	3.00		CSE-435	Distributed Algorithms	3.00
81.	CSE-437	Bioinformatics	3.00		CSE-437	Bioinformatics	3.00
82.	CSE-439	Robotics	3.00		CSE-439	Robotics	3.00
83.	CSE 441	Machine Learning	3.00		CSE 441	Machine Learning	3.00
84.	CSE 442	Machine Learning Sessional	0.75		CSE 442	Machine Learning Sessional	0.75
85.	CSE-429	Computer Security	3.00		CSE-429	Computer Security	3.00
86.	CSE-413	Computer Graphics	3.00		CSE-413	Computer Graphics	3.00
87.	CSE-414	Computer Graphics Sessional	0.75		CSE-414	Computer Graphics Sessional	0.75
88.	HUM-415	Financial and Managerial Accounting	2.00		HUM-415	Financial and Managerial Accounting	2.00
89.	HUM-417	Engineering Management and Ethics	3.00		HUM-417	Engineering Management and Ethics	3.00
90.	CSE- 451	Simulation and Modeling	3.00		CSE- 451	Simulation and Modeling	3.00
91.	CSE- 452	Simulation and Modeling Sessional	0.75		CSE- 452	Simulation and Modeling Sessional	0.75
92.	CSE- 453	Data Ware-housing and Data Mining	3.00		CSE- 453	Data Ware-housing and Data Mining	3.00
93.	CSE- 454	Data Ware-housing and Data Mining Sessional	0.75		CSE- 454	Data Ware-housing and Data Mining Sessional	0.75
94.	CSE-443	Pattern Recognition	3.00		CSE-443	Pattern Recognition	3.00
95.	CSE-444	Pattern Recognition Sessional	0.75		CSE-444	Pattern Recognition Sessional	0.75
96.	CSE-445	Digital Signal Processing	3.00		CSE-445	Digital Signal Processing	3.00
97.	CSE-446	Digital Signal Processing Sessional	0.75		CSE-446	Digital Signal Processing Sessional	0.75
98.	CSE- 447	Telecommunication Engineering	3.00		CSE- 447	Telecommunication Engineering	3.00
99.	CSE-449	Mobile and Ubiquitous Computing	3.00		CSE-449	Mobile and Ubiquitous Computing	3.00
100.	CSE-450	Mobile and Ubiquitous Computing Sessional	0.75		CSE-450	Mobile and Ubiquitous Computing Sessional	0.75
101.	CSE-411	VLSI Design	3.00		CSE-411	VLSI Design	3.00
102.	CSE-412	VLSI Design Sessional	0.75		CSE-412	VLSI Design Sessional	0.75

	Old Course (2018-2020)				New Course (2019-2021)		
Ser.	**Course No.**	**Course Title**	**Cr.**		**Course No.**	**Course Title**	**Cr.**
103.	CSE-455	Natural Language Processing using Deep Learning	3.00		CSE-455	Natural Language Processing using Deep Learning	3.00
104.	CSE-456	Natural Language Processing using Deep Learning Sessional	0.75		CSE-456	Natural Language Processing using Deep Learning Sessional	0.75
105.	CSE-457	Advance Database Management Systems	3.00		CSE-457	Advance Database Management Systems	3.00
106.	CSE-458	Advance Database Management Systems Sessional	0.75		CSE-458	Advance Database Management Systems Sessional	0.75