MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

SYLLABUS

BACHELOR OF SCIENCE
IN
COMPUTER SCIENCE AND ENGINEERING (CSE)

APPLICABLE FOR CSE – 24 TO ONWARD BATCHES

REVISED ON MARCH 2024

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.

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.

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Note: A student needs to take all the core courses along with inter-disciplinary courses and a total 6 credit hours of theory courses from Technical Elective courses and 1.5 cr hr of sessional course from Technical elective courses to complete the graduation

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 Gambia 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 of MIST 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.
- Continuous effort to build strong industry-academia bondage.

1.3 Mission and Vision of MIST

1.3.1 Vision of MIST

To be a center of excellence for providing quality education in the field of science, engineering and technology and conduct research to meet the national and global challenges.

1.3.2 Mission Statement

MIST is working on the following missions:

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

ii. 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. Conduct collaborative research activities with national and international communities for continuous interaction with academia and industry.

iv. Provide consultancy, advisory, testing, and other related services to government, non-government and autonomous organization including personal for widening practical knowledge and to contribute in sustainable development of the society.

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 Civil Engineering (FCE)

Faculty of CE comprises of following departments:

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

1.8.2 Faculty of Electrical & Computer Engineering (FECE)

Faculty of ECE comprises of the following two departments:

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

1.8.3 Faculty of Mechanical Engineering (FME)

Faculty of ME comprises of the following departments:

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

1.8.4 Faculty of Science & Engineering (FSE)

Faculty of SE comprises of the following departments:

- 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.

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

The students must fulfill the following requirements:

1.9.1 Bangladeshi Students

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

a) 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.

b) 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.

c) 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.

d) 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.

e) 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.

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

g) Sex: Male and female.

1.9.2 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:

a) Educational qualifications as applicable for Bangladeshi civil students or equivalent.
b) Must have security clearance from respective Embassy/ High Commission in Bangladesh.
c) 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 generally conducted out of 200 marks and the syllabus and distribution of marks is given below:

Serial	Subjects	Syllabus	Marks
1	Mathematics	Syllabus 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%. Students are taken as per merit and quota.

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 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, may re-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 Behaviours

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 COMPUTER SCIENCE 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 1 December 2023 for four years in 2023.

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, Intelligent Computing, Cyber security, Research etc.

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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

The mission of the Dept of CSE is drawn from the vision of MIST. The four-pronged missions of the Dept of CSE are as under.

i. To impart quality education for creating new knowledge.
ii. To produce skilled human resources capable of solving prevailing and emerging problems in the field of CSE.
iii. To contribute towards the advancement of human society to meet the ethical, economical, environmental and social norms.
iv. To infuse leadership qualities amongst the students and to encourage them to follow successful professional career paths as well as pursue advanced studies in computer engineering and be a life-long learner to the latest developments in the field of computing and IT.

2.3.1.3 Program Educational Outcomes (PEOs)

Graduates of the Computer Science and Engineering program are expected to attain or achieve the following Program Educational Objectives within a few years of graduation:

i. PEO 1: Graduates will grow and develop in their chosen profession and/or progress toward an advanced degree by giving innovative solutions to complex problems.
ii. PEO 2: Graduates will earn respect from others and demonstrate reliability as effective and ethical team members and achieve positions of leadership in an organization and/or in teams.

iii. PEO 3: Graduates will be able to establish or run sustainable business enterprises along diverse career paths by creating, selecting and applying appropriate and modern technologies, skills and tools.

iv. PEO 4: Graduates will be able to contribute to the educational, cultural, social, technological and economic development of society through the ethical application of their knowledge and skills.

2.3.1.4 Program Outcomes (POs)

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.

Table 1 List of Program Outcomes

Serial	PO	Description
1	**POa**	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.
2	**POb**	Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4).
3	**POc**	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5).
4	**POd**	Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5	**POe**	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (K6).
6	**POf**	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7).
7	**POg**	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7).
8	**POh**	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7).
9	**POi**	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10	**POj**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**POk**	Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Serial	PO	Description
12	**POl**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

2.3.1.5 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).

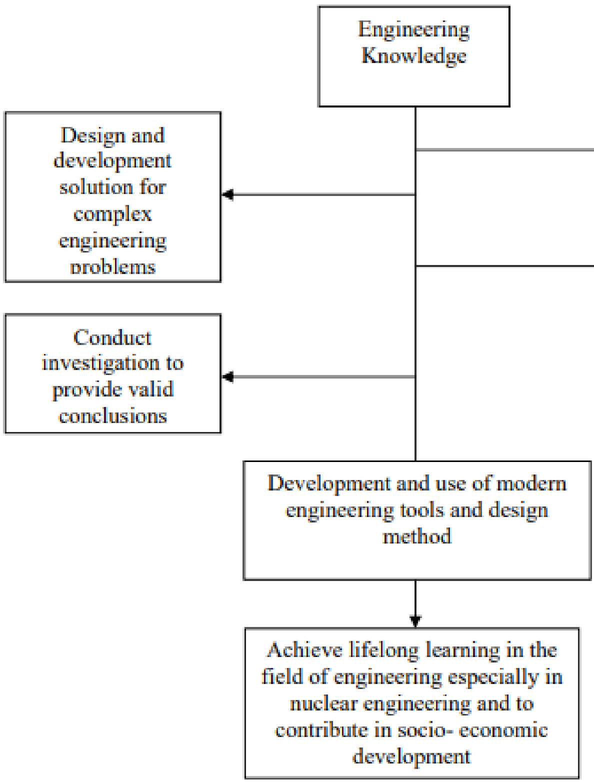
2.3.1.6 Generic Skills

After completion of the course, the graduates will be able to achieve certain level of Knowledge Profile, range of Complex Problem solving, range of Complex Engineering Activities, Learning Domain which are given in detail in Appendix A.

2.3.1.7 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.

However, generic curriculum/ skill mapping is shown below:



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 Design 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.

Artificial Intelligence and Robotics Lab: There is an Artificial Intelligence 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 Lab: This department has a Network 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.

Multimedia and Graphics Lab: This department has a Multimedia and Graphics 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.

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.

Mobile Apps and Game Testing Lab: This department has a Mobile Apps and Game Testing Lab consisting of 10 computers as workstation donated by ICT Division on 11 December 2017. The lab is mainly established for development and testing of mobile applications and games. Classes can be conducted for 20 students at a time. All necessary equipment including Computers (Brand and Model: HP EliteDesk 800 G3), Android Tab (Brand and Model: Samsung Galaxy Tab S3), Android Phone (Brand and Model: Samsung Galaxy Note 8), Wacom Intuos Pre Medium (Brand and Model: PTH-660/KO-CX) and other necessary software are available in this lab.

Intelligent Computing Lab: This department has an Intelligent Computing Lab consisting of 60 computers as workstation donated by ICT Division on 8 August 2023. The lab is mainly established for development and testing of mobile applications and games. Classes can be conducted for 20 students at a time. All necessary equipment including 56 Computers (Brand and Model: DELL Model OPTIPLEX 7040**,** 16GB RAM, Core i7 12th generation processor), 6 high comfiguration computers((Brand and Model **:** DELL Model: OPTIPLEX 7040**,** 32GB RAM, Core i7 12th generation processor) UPS (Brand: APOLLO Model:650-VA), Interactive Flat Panel (Brand: BenQ Model: RE9801, IE 1002), Side Display (Brand: Samsung Model), Auto Tracking Camera for Speaker (Brand: LUMENS Model:VC-TR1), PTZ

Camera for students (Brand: LUMENS Model:VC-A50P), Document Camera (Brand: LUMENS Model: DC-F80), Conference Kit (Brand: Televic) and other necessary software are available in this lab.

Cyber Range: This department has a Cyber Range located in Tower-3, 3rd floor. This is the first ever Cyber Range facility in any academic institute of Bangladesh. It is a Cyber Wargame Center for real-life experience in responding and defending against cyber-attacks. It provides hands-on training to practice detecting, investigating, and responding to simulated live cyber-attacks. Training scenarios are focused on Fintech, IT, and Law Enforcing Agencies. There are 33 hands on training scenarios (16 SOC Basic Training Scenarios, 14 Advanced Training Scenarios, 3 Industrial control system (ICS) packages). Some offered courses are

1. Information Security Assessment and Penetration Testing (SAPT)
2. Cyber security Operation Center and Threat Hunting (SOC)
3. Ethical Hacking, Countermeasures & VAPT
4. Digital Forensic Investigation
5. Information Systems Security Architecture
6. Application Software and Cloud Security
7. Information Systems Auditing and any other customized course.

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) Advanced Computing Lab

The laboratories of CSE Department are also used 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 MIST International Journal of Science and Technology (MIJST) biannually (June and December) where faculties and students of CSE department put their contributions. MIJST is a peer-reviewed open-access journal of the Military Institute of Science and Technology (MIST). The OJS system based MIJST is designed for publishing open-access journal articles based on PHP, MySQL, Javascript, CSS, etc. As the MIJST Platform is an online system, it will provide a wide range of facilities for students, researchers, publishers, and readers from all over the world through knowledge sharing and research collaboration.

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.

CHAPTER 3

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM

3.1 Overview

MIST has started 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 policy 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 06 or as per syllabus in each term. However, with the recommendation of course coordinator and Head of the Department, Commandant MIST may allow up to 07 courses in exceptional cases if department can accommodate within 24 credit hours.
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 Spring Term (Jan-Jun) and Fall Term (Jul-Dec) in an academic year.

3.4 Duration of Terms

The duration of each of Spring Term and Fall Term (maximum 22 weeks) may be as under:

Serial	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

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 theoretical 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. **<u>Program Core:</u>**

   i. **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 the entire designated core courses of his/her discipline.

   ii. **Technical Elective Courses**: Apart from the core courses, the students can choose from a set of technical elective courses. A required number of elective courses from a specified group have to be chosen.

b. **<u>University Core</u>**:

   i. **Language/Communicative Language**: This category includes different communicative languages like English which is also a mandatory for students.

   ii. **General education courses:** This category covers Sociology, Bangladesh Studies, Leadership and Management, Environment Sustainability and Law, Ethics and moral philosophy.

   iii. **Basic Science courses:** This category covers Physics and Chemistry courses and they are accompanied with appropriate laboratory works.

   iv. **Mathematics:** Students must complete four mathematics course to attain the degree which includes differential and integral calculus, vector analysis, matrix and coordinate geometry, differential equations, Laplace transform and Fourier transform, complex variable and statistics.

   v. **Interdisciplinary courses:** Some other departmental basic courses offered by other departments like CE, ME, EECE falls under this category.

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.

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 as per Institution policy. Penalty for late registration will not be waived.

3.13 Limits on the Credit Hours

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 Commandant, a lesser number of credit hours to suit individual requirements. Only graduating students may be allowed to register less than 15 Cr Hr without approval of Commandant. A list of all such cases to be forwarded to Register Office, ICT directorate and Controller of Exam Office by the respective Department.

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. Dropping a course is permitted within the first four weeks of a regular term. Add or drop is not allowed after registration of courses for Supplementary-I and Supplementary-II Examination.

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 to be 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:

Grading System		
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
	AB	Absent
	DC	Dis-collegiate
	VW	Voluntary Withdrawn
	X	Project/ Thesis Continuation
	E	Expelled
	S	Satisfactory

* 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

Forty percent (40%) of marks of a theoretical course shall be allotted for Continuous Assessment, i.e. assignments, class tests, pop quizzes, observations, projects and mid-term assessment. These marks must be submitted to Office of the Controller of Examinations before commencement of the final exam. The rest of the marks will be allotted to the Term Final

Examination. The duration of final examination will be three (03) hours. The scheme of continuous assessment that a particular teacher would follow for a course will be announced on the first day of the classes. Distribution of marks for a given course per credit is as follows:

Class Performance	5%
Class Test/Assignment	20%
Mid-Term Assessment (Exam/Project)	10%
Class Attendance	5%
Final Examination (Section A & B)	60%
Total	100%

Note:

a. In final exam, each section can be used for achieving not more than two course outcomes (COs). The remaining COs should be attained from mid-term assessment or class tests. Course teacher has to inform the student the beginning of the terms.

b. Course teacher of a particular course has to inform the department whether he/she wants to assess mid-term through exam or project within first two weeks of beginning of a term. The duration of mid-term examination should not be more than 50 minutes which has to be conducted in between 6th to 9th week of a semester. If mid-term assessment is done through project, then there should be project report and presentation.

c. The weightage of class performance can be assessed through checking attentiveness during classes or arranging unnoticed pop quizzes.

d. The number of class tests shall be n for 3.0 and above credit courses and (n-1) shall be considered for grading where n is the number of credits of the course. However, for courses having credits below 3.0, the considered class tests shall be 2 out of 3.

e. All class test will carry 20 marks each. Exam software system will finally convert these achieved marks into total class test marks as per credit hour. i.e for n=1(20), n=2 (40), n=3 (60), n=4(80) etc.

f. Irrespective of the result of the continuous assessment (class performance, class test, mid-term assessment), a student has to appear in the final examination (where applicable) for qualifying/passing the concern course/ subject.

3.17.2 Laboratory/Sessional/Practical Examinations

Laboratory/sessional courses are designed and conducted by the concerned departments. Examination on laboratory/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 laboratory/sessional courses on the basis of the followings:

Conduct of Lab Tests/Class Performance	25%
Report Writing/Programming	15%
Mid-Term Evaluation (exam/project/assignment)	20%
Final Evaluation (exam/project/assignment)	30%
Viva Voce/Presentation	10%
Total	100%

<u>Note:</u> the above distribution of percentage is a general guideline. Department can rearrange to some extent if required.

3.17.3 Laboratory/Sessional Course in English

The distribution will be as under:

Class performance/observation	10%
Written Assignment	15%
Oral Performance	25%
Listening Skill	10%
Group Presentation	30%
Viva Voce	10%
Total	100%

3.17.4 Class attendance

Class attendance may be considered as a part of continuous assessment. No mark will be allotted for attending classes.

3.18 Collegiate, Non-collegiate and Dis-collegiate

Students having class attendance of 85% or above in individual subject will be treated as collegiate and less than 85% and up to 70% 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 attendance below 70% 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

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

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

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

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

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

Numerical Example: Suppose a student has completed nine 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**

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

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

Level	Term	Earned Credit Hours	Earned GPA	TCi*GPAi
		TCi	**GPAi**	
1	Spring	21.75	3.75	81.5625
1	Fall	20.75	3.61	74.9075
2	Spring	19.50	3.21	62.595
2	Fall	21.00	2.98	62.58
Total		83.00		281.645

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

3.20 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.

3.21 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.

3.22 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 supplementary exams, if there are any, with better grades. When the minimum GPA and credit requirements are achieved the student is again returned to good standing.

3.23 Minimum Earned Credit and GPA Requirement for Obtaining Degree

Minimum credit hour requirements for the award of Bachelor's degree in Computer Science and Engineering (BSc Engg) must be of minimum 160 credit hours. A student must earn minimum 160 credit hour set in the for qualifying Bachelor's Degree. The minimum CGPA 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 CGPA, but he/she may take a maximum of 15 such additional credits(maximum 6 subjects) in computer science ad engineering beyond respective credit-hour requirements for Bachelor's degree during his/her entire period of study.

3.24 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.

3.25 Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of six years for engineering and seven years for architecture bachelor's degrees.

3.26 Attendance, Conduct and Discipline

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

3.26.1 Attendance

All students are expected to attend classes regularly. MIST 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.

3.26.2 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.

3.27 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.

3.28 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).

3.29 Recognition of Performance

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

3.30 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. **Supplementary Examination:** It will take place twice in a year. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun)/Fall Term(Jul-Dec) end break and Supplementary-II in the first week of Fall Term (Jul-Dec)/ Spring Term (Jan-Jun) end break, respectively. Students will be allowed to register for a maximum of two theory courses

(Failed/Improvement) in Supplementary-I and maximum of one theory course (Failed/Improvement) in Supplementary-II.

c. **<u>Improvement Examination</u>:** It will be taken during Supplementary-I and Supplementary-II Examination. Questions will be same as the question of the regular examination of that Supplementary Examination (if any). Student can take maximum two subjects at a time (two subjects in supplementary-I and one subject in supplementary-II) 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.

3.31 Rules of Different Examinations

3.31.1 Term Final Examination

Following rules to be followed:

a. Registration to be completed before commencement of the Term. 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 two weeks 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.

3.31.2 Supplementary Examination

Following rules to be followed:

a. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun)/Fall Term (Jul-Dec) end break and Supplementary-II in the first week of Fall Term (Jul-Dec)/Spring Term (Jan-Jun) end break, respectively.
b. Students will be allowed to register for a maximum of two theory courses (Failed/Improvement) in Supplementary-I and maximum of one theory course (Failed/Improvement) in Supplementary-II.
c. No class will be conducted.
d. 40% marks will be considered from the previous exams.
e. Maximum grading in Supplementary Exam will be 'B+'.
f. No Sessional Exam will be conducted.
g. Examination will be taken on 60% marks like Term Final Examination.
h. If a student fails in a course more than once in regular terms, then for calculating 40% marks best one of all continuous assessment marks will be counted.
i. If anyone fails in the laboratory/sessional course, that course cannot be taken in the supplementary examination.

j. 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. Any one fails twice in a course, can only retake it in the regular term for appearing third time. But anyone fails even after appearing third time. He/she has to take approval of Academic Council of MIST for appearing 4th (last) time in a course and need to pay extra financial penalty. If any student fails even 4thtime in a course, will not be allowed to appear anymore in this same course.
k. Registration of Supplementary-I Exam to be done within 5th week after completion of Fall Term (July to Dec) and registration of Supplementary-II exam to be done during the Mid-Term break of Spring Term (Jan to Jun), paying all the required fees.
l. There will be no provision for add/drop courses after registration.
m. Question Setting, Moderation, and Result Publication to be done following the same rules of Spring (Jan to Jun)/ Fall (July to Dec) Term Final Exam as per existing Examination Policy.
n. Moderation of the questions for Supplementary-I will be done in the 5th week after completion of Fall Term (July to Dec) Final Exam and Supplementary-II with the moderation of the questions of Spring Term (Jan to Jun).
o. Separate Tabulation sheet to be made.
p. **Final Year Research & Design Project:** If a student cannot complete thesis in two consecutive terms, with the recommendation of the supervisor, he/she may continue for next one/two term within six academic years.

3.31.3 Improvement Examination

Following rules to be followed:

a. Improvement examination is to be taken during the Supplementary-I and Supplementary-II examinations.
b. For Improvement examination, registration is to be done during the registration of Supplementary-I and Supplementary-II examinations by paying all the fees.
c. Question Setting, Moderation and Result Publication to be done with courses of Supplementary-I and Supplementary-II examinations.
d. 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.
e. Highest grade of Improvement examination will be 'B+'.
f. One student is allowed to appear at Improvement exam in 6 (six) courses in his whole graduation period taking maximum two courses at a time (two courses at supplementary-I and one course at supplementary-II).

The summary of all types of examinations are given briefly in Appendix B.

3.32 Irregular Graduation

If any graduating student clears his/her failed course in Spring Term/Fall Term/ Supplementary examinations and his graduation requirements are fulfilled, his graduation will be effective from the result publication date of Spring Term/Fall Term/Supplementary examinations 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 SPRING TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE -101	Discrete Mathematics	3.00	-	3.00	
2	CHEM-101	Fundamentals of Chemistry	3.00	-	3.00	
3	CHEM-102	Chemistry Sessional	-	1.50	0.75	
4	EECE-163	Electrical Circuit Analysis	3.00	-	3.00	
5	EECE-164	Electrical Circuit Analysis Sessional	-	1.50	0.75	
6	GEBS-101	Bangladesh Studies	2.00	-	2.00	
7	MATH-101	Differential and Integral Calculus	3.00	-	3.00	
8	PHY-101	Waves and Oscillations, Optics and Modern Physics	3.00	-	3.00	
9	PHY-102	Physics Sessional	-	3.00	1.50	
	Total		**17.00**	**6.00**	**20.00**	

LEVEL-1 FALL TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CE-150	Engineering Drawing and CAD Sessional	-	1.50	0.75	
2	CSE-103	Digital Logic Design	3.00	-	3.00	
3	CSE-104	Digital Logic Design Sessional	-	3.00	1.50	
4	CSE-105	Structured Programming Language	3.00	-	3.00	
5	CSE-106	Structured Programming Language Sessional	-	3.00	1.50	
6	EECE-169	Electronic Devices and Circuits	3.00	-	3.00	EECE-163
7	EECE-170	Electronic Devices and Circuits Sessional	-	1.50	0.75	EECE-164
8	LANG-102	Communicative English-I	-	3.00	1.50	
9	MATH-105	Vector Analysis, Matrix and Coordinate Geometry	3.00	-	3.00	
10	ME-122	Fundamental of Mechanical Engineering Sessional	-	4.00	2.00	
	Total		**12.00**	**16.00**	**20.00**	

LEVEL-2 SPRING TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE-203	Data Structures and Algorithms-I	3.00	-	3.00	CSE-105
2	CSE-204	Data Structures and Algorithms-I Sessional	-	3.00	1.50	
3	CSE-205	Object Oriented Programming Language	3.00	-	3.00	CSE-105
4	CSE-206	Object Oriented Programming Language Sessional-I	-	3.00	1.50	
5	CSE-217	Theory of Computation	3.00	-	3.00	
6	EECE-269	Electrical Drives and Instrumentation	3.00	-	3.00	EECE-169
7	EECE-270	Electrical Drives and Instrumentation Sessional	-	1.50	0.75	EECE-170
8	LANG-202	Communicative English-II	-	3.00	1.50	
9	MATH-205	Differential Equations, Laplace Transform and Fourier Transform	3.00	-	3.00	
	Total		**15.00**	**10.50**	**20.25**	

LEVEL-2 FALL TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE-213	Computer Architecture	3.00	-	3.00	
2	CSE-215	Data Structures and Algorithms-II	3.00	-	3.00	
3	CSE-216	Data Structures and Algorithms-II Sessional	-	3.00	1.50	
4	CSE-219	Mathematical Analysis for Computer Science	3.00	-	3.00	
5	CSE-220	Object Oriented Programming Sessional-II	-	4.00	2.00	
6	EECE-279	Digital Electronics and Pulse Technique	3.00	-	3.00	
7	EECE-280	Digital Electronics and Pulse Technique Sessional	-	1.50	0.75	
8	GELM-275	Leadership and Management	2.00	-	2.00	
9	MATH-207	Complex Variable and Statistics	3.00	-	3.00	MATH-101
	Total		**17.00**	**8.50**	**21.25**	

LEVEL-3 SPRING TERM

Ser	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	3.00	-	3.00	CSE-103
6	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	-	3.00	1.50	CSE-104
7	CSE-307	Operating System	3.00	-	3.00	
8	CSE-308	Operating System Sessional	-	1.50	0.75	
9	CSE-317	Data Communication	3.00	-	3.00	
10	CSE-318	Data Communication Sessional	-	1.50	0.75	
	Total		**15.00**	**10.50**	**20.25**	

LEVEL-3 FALL TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE-309	Computer Network	3.00	-	3.00	CSE-317
2	CSE-310	Computer Network Sessional	-	3.00	1.50	
3	CSE-315	Digital System Design	2.00	-	2.00	CSE-305
4	CSE-316	Digital System Design Sessional	-	1.50	0.75	
5	CSE-319	Software Engineering	3.00	-	3.00	
6	CSE-320	Software Engineering Sessional	-	1.50	0.75	
7	CSE-364	Software Development Project	-	3.00	1.50	
8	GERM-352	Fundamentals of Research Methodology	-	3.00	1.50	
9	GES-301	Fundamentals of Sociology	2.00	-	2.00	
10	GESL-303	Environment, Sustainability and Law	2.00	-	2.00	
	Total		**12.00**	**12.00**	**19.00***	

***LEVEL-3 INDUSTRIAL TRAINING**

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	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. Total credit of Level-3 Fall Term is 19.00 Cr. Hr. including the 1.00 Cr. of CSE-350.

LEVEL-4 SPRING TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE-400	Final Year Research & Design Project	-	6.00	3.00	
2	CSE-405	Computer Interfacing	3.00	-	3.00	CSE-305
3	CSE-406	Computer Interfacing Sessional	-	1.50	0.75	
4	CSE-415	Human Computer Interaction	3.00	-	3.00	
5	CSE-416	Human Computer Interaction Sessional	-	1.50	0.75	
6	CSE-403	Artificial Intelligence	3.00	-	3.00	
7	CSE-404	Artificial Intelligence Sessional	-	1.50	0.75	
8	CSE-4XO	Technical Elective-I	3.00	-	3.00	
9	CSE-4XE	Technical Elective-I Sessional	-	1.50	0.75	
10	GEEM-433	Engineering Ethics and Moral Philosophy	2.00	-	2.00	
	Total		**14.00**	**12.00**	**20.00**	

TECHNICAL ELECTIVE-I

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-417	Blockchaining and Cryptocurrency Technology	3.00	-	3.00	
2.	CSE-418	Blockchaining and Cryptocurrency Technology Sessional	-	1.50	0.75	
3.	CSE-419	Advanced Algorithms	3.00	-	3.00	
4.	CSE-420	Advanced Algorithms Sessional				
5.	CSE-421	Basic Graph Theory	3.00	-	3.00	
6.	CSE-422	Basic Graph Theory Sessional	-	1.50	0.75	
7.	CSE-423	Fault Tolerance System	3.00	-	3.00	
8.	CSE-424	Fault Tolerance System Sessional	-	1.50	0.75	
9.	CSE-425	Basic Multimedia Theory	3.00	-	3.00	
10.	CSE-426	Basic Multimedia Theory Sessional	-	1.50	0.75	
11.	CSE-427	Digital Image Processing	3.00	-	3.00	
12.	CSE-428	Digital Image Processing Sessional	-	1.50	0.75	
13.	CSE-431	Object Oriented Software Engineering	3.00	-	3.00	
14.	CSE-432	Object Oriented Software Engineering Sessional	-	1.50	0.75	
15.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00	-	3.00	
16.	CSE-434	Artificial Neural Networks and Fuzzy Systems Sessional	-	1.50	0.75	
17.	CSE-435	Distributed Algorithms	3.00	-	3.00	
18.	CSE-436	Distributed Algorithms Sessional				
19.	CSE-437	Bioinformatics	3.00	-	3.00	
20.	CSE-438	Bioinformatics Sessional	-	1.50	0.75	
21.	CSE-439	Robotics	3.00	-	3.00	
22.	CSE-440	Robotics Sessional	-	1.50	0.75	
23.	CSE-447	Telecommunication Engineering	3.00	-	3.00	
24.	CSE-448	Telecommunication Engineering Sessional	-	1.50	0.75	

LEVEL-4 FALL TERM

Ser	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1	CSE-400	Final Year Research & Design Project	-	6.00	3.00	
2	CSE-401	Information System Design and Development	3.00	-	3.00	CSE-319
3	CSE-429	Computer Security	3.00	-	3.00	
4	CSE-430	Computer Security Sessional	-	1.50	0.75	
5	CSE-413	Computer Graphics	3.00	-	3.00	
6	CSE-414	Computer Graphics Sessional	-	1.50	0.75	
7	CSE-4XO	Technical Elective-II	3.00	-	3.00	
8	CSE-4XE	Technical Elective-II Sessional	-	1.50	0.75	
9	GEPM-463	Project Management and Finance	2.00	-	2.00	
	Total		**14.00**	**10.50**	**19.25**	

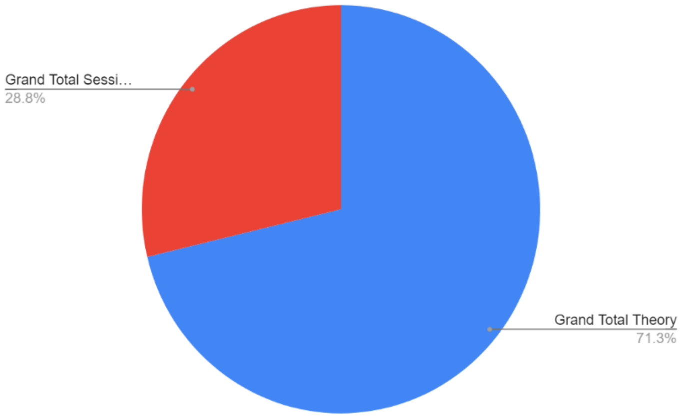
TECHNICAL ELECTIVE -II

Ser	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-455	Natural Language Processing	3.00	-	3.00	
14.	CSE-456	Natural Language Processing Sessional	-	1.50	0.75	
15.	CSE-457	Advanced Database Management Systems	3.00	-	3.00	
16.	CSE-458	Advanced Database Management Systems Sessional	-	1.50	0.75	
17.	CSE-459	Internet of Things (IoT)	3.00	-	3.00	
18.	CSE-460	Internet of Things (IoT) Sessional	-	1.50	0.75	
19.	CSE-461	Industrial Revolution	3.00	-	3.00	
20.	CSE-462	Industrial Revolution Sessional	-	1.50	0.75	
21.	CSE-465	Cyber & Physical Security	3.00	-	3.00	
22.	CSE-466	Cyber & Physical Security Sessional	-	1.50	0.75	

SUMMARY

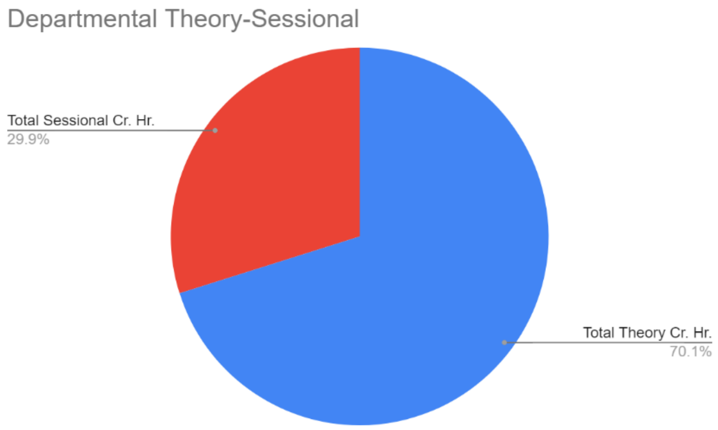
Summary of Departmental, Inter-disciplinary, Basic Science and Humanities Theory and Sessional Courses								
Level and Term	**Hours/Week**		**Total Cont. Hours**	**Credits**		**Total Credit**	**No of Courses**	
	Theory	**Sessional**		**Theory**	**Sessional**		**Theory**	**Sessional**
Level 1 Spring Term	17	6	23	17	3	20	6	3
Level 1 Fall Term	12	16	28	12	8	20	4	5
Level 2 Spring Term	15	10.5	25.5	15	5.25	20.25	5	4
Level 2 Fall Term	17	8.5	25.5	15	6.25	21.25	6	3
Level 3 Spring Term	15	10.5	25.5	15	5.25	20.25	5	5
Level 3 Fall Term	12	12	24	12	7	19	5	6
Level 4 Spring Term	14	12	26	14	6	20	4	4
Level 4 Fall Term	14	10.5	24.5	14	5.25	19.25	5	4
	116	**86**	**202**	**114**	**46**	**160**	**40**	**34**

Pie Chart



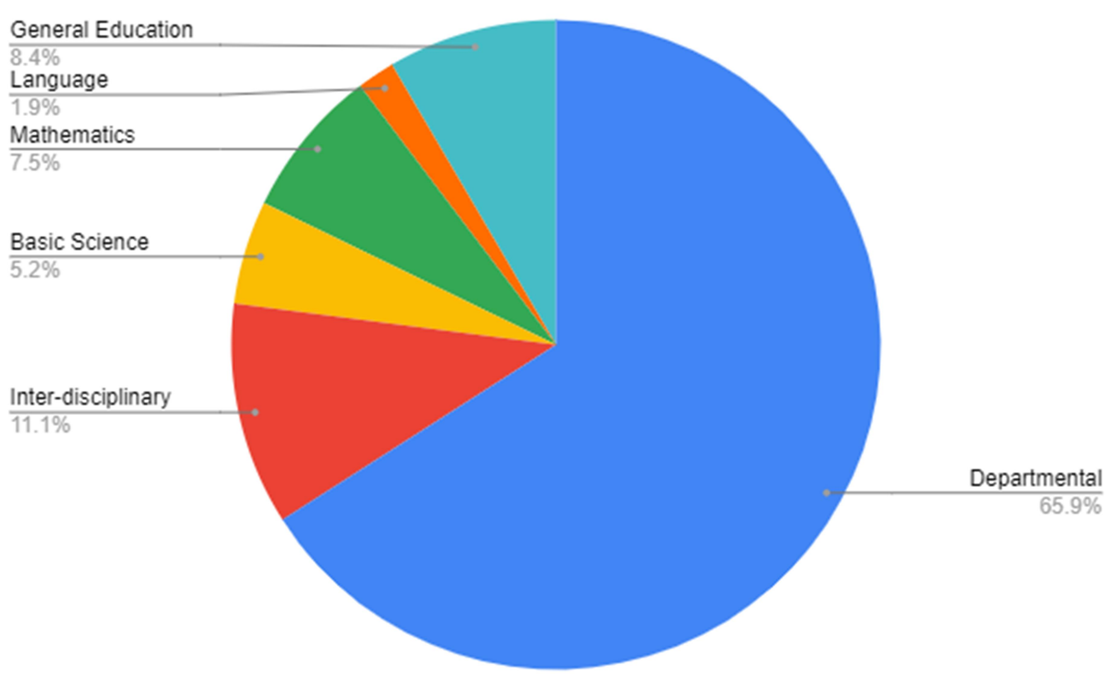
Summary of Departmental Theory and Sessional Courses			
Level/ Term	**Theory Cr. Hr.**	**Sessional Cr. Hr.**	**Total Cr. Hr.**
Level-1 Spring Term	3	0	3
Level-1 Fall Term	6	3	9
Level-2 Spring Term	9	3	12
Level-2 Fall Term	9	3.5	12.5
Level-3 Spring Term	15	5.25	20.25
Level-3 Fall Term	8	5.5	13.5
Level-4 Spring Term	12	6	18
Level-4 Fall Term	12	5.25	17.25
Total	**74**	**31.5**	**105.5**

Pie Chart



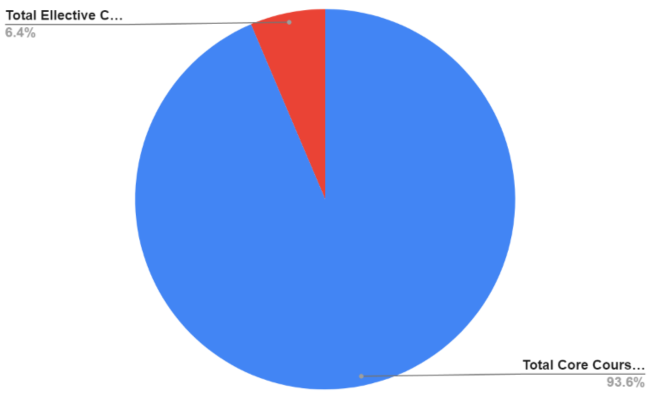
Summary of Departmental, Inter-disciplinary, Basic Science, Language and General Education Courses							
Level/Term	**Departmental**	**Inter-disciplinary**	**Basic Science**	**Mathematics**	**Language**	**General Education**	**Total**
Level 1 Spring Term	3	3.75	8.25	3	0	2	20
Level 1 Fall Term	9	6.5	0	3	1.5	0	20
Level 2 Spring Term	12	3.75	0	3	1.5	0	20.25
Level 2 Fall Term	12.5	3.75	0	3	0	2	21.25
Level 3 Spring Term	20.25	0	0	0	0	0	20.25
Level 3 Fall Term	13.5	0	0	0	0	5.5	19
Level 4 Spring Term	18	0	0	0	0	2	20
Level 4 Fall Term	17.25	0	0	0	0	2	19.25
Total	**105.5**	**17.75**	**8.25**	**12**	**3**	**13.5**	**160**

Pie Chart



Summary of Departmental Core and Elective Courses		
Level/Term	**Core**	**Elective**
Level 1 Spring Term	3	0
Level 1 Fall Term	9	0
Level 2 Spring Term	12	0
Level 2 Fall Term	12.5	0
Level 3 Spring Term	20.25	0
Level 3 Fall Term	13.5	0
Level 4 Spring Term	15	3
Level 4 Fall Term	13.5	3.75
Total	**98.75**	**6.75**

Pie Chart



CHAPTER 5

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

LEVEL-1 SPRING TERM

CSE-101: Discrete Mathematics

COURSE INFORMATION			
Course Code Course Title	: CSE-101 : Discrete Mathematics	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The course is designed to develop logical thinking and its application to computer science (to emphasize the importance of proving statements correctly and de-emphasize the hand-waving approach towards correctness of an argument). The subject enhances one ‘s ability to reason and ability to present a coherent and mathematically accurate argument.

OBJECTIVE

1. To introduce Discrete Mathematics and its applications.
2. To introduce some of the problems of Discrete Mathematics. To develop knowledge of a variety of mathematical tools applicable in computer science.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom’s Taxonomy	CP	CA	KP	Assessment Methods
CO1	Define an argument using logical notation and determine if the argument is or is not valid.	C2-C3	1		1	T, ASG
CO2	Construct simple mathematical proofs and possess the ability to verify them.	C2, C3			1,2	T, F
CO3	Demonstrate the understanding of sets, relations and functions and modeling problems using graphs and trees.	C2-C3			1, 2	Mid Term, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

The Foundations of logic and proofs: Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Methods of Proofs; Basic Structures of Sets and Functions: Sets, Set Operations, Functions; Algorithms: Algorithms, Integers and Division, Integers and Algorithms, Mathematical Reasoning; Induction and Recursion: Mathematical Induction, Mathematical Reasoning, Recursive Definitions and Structural Induction; Counting Methods: Pigeonhole Principle and applications, Advance Counting Techniques, Recurrence Relations; Relations: Properties of Relations, Representing Relations, Equivalence Relations; Graphs and Trees: Introduction to Graphs and Trees, graph models, representing graphs and graph isomorphism, Euler and Hamilton Path, Application of trees.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define an argument using logical notation and determine if the argument is or is not valid.	H											
CO2	Construct simple mathematical proofs and possess the ability to verify them.		H										
CO3	Demonstrate the understanding of sets, relations and functions and modeling problems using graphs and trees.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Be skillful in expressing mathematical properties formally via the formal language by applying the knowledge fundamentals to the solution of complex engineering problems.
CO2-POb	High	Develop the ability to evaluate a proof on the basic structure of each proof technique described.
CO3-POc	High	Be able to specify and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to design solutions using properties of graphs and tree.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
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	The Foundations: Sets, Set Operations, Functions	Class Test 2

	Lec 12		
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	Mid Term Exam
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 3
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	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	CO1	C2-C3
			CO2	C4
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO2	C4
Final Exam		60%	CO2	C4
			CO3	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Discrete Mathematics and its Applications, 7th Edition by K. Rosen, McGraw Hill.
2. Discrete Mathematics with Applications, 3rd Edition by Susanna S. Epp Gagne

REFERENCE SITE

CHEM-101: Fundamentals of Chemistry

COURSE INFORMATION			
Course Code Course Title	: CHEM-101 : Fundamentals of Chemistry	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to learn the basic chemistry in the field of inorganic, organic and physical chemistry. The course will be emphasized on the basic concepts, theories and to solve quantitative problems which can be applicable in a wide spectrum of engineering disciplines.

OBJECTIVE

1. To define the different parameters and concepts of inorganic chemistry and physical chemistry
2. To explain the basic reaction mechanism of selective organic reactions.
3. To solve numerical problems of inorganic, organic and physical chemistry.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Define** different basic parameters in the field of inorganic, organic and physical chemistry i.e., atomic structure, periodic table, chemical bonding, acids and bases, chemical equilibrium, thermochemistry and different types of solutions, phase rule etc.	C1	1,2,3	1	1	T, F, MT
CO2	**Explain** different basic theories in the field of selective organic reactions such as Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions etc.	C2			1	T, F, MT
CO3	**Solve** quantitative problems in the field of inorganic, organic and physical chemistry i.e. solutions, thermochemistry, chemical kinetics, electrical properties of solution etc.	C3			2	T, F, MT, ASG
CO4	**Develop** the communication skill by presenting topics on operating systems.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Atomic Structure: Concepts of atomic structure, Different atom models, Quantum theory and electronic configurations, Heisenberg's uncertainty principle

Periodic Table: Periodic classification of elements, Periodic properties of elements, Properties and uses of noble gases

Chemical Bonding: Types and properties, Lewis theory, VBT, MOT, Hybridization and shapes of molecules

Basic Concepts of Organic Chemistry: History, Physical and chemical properties, Classification
Hydrocarbon: Chemistry of hydrocarbon, Nomenclature, Properties
Selective Organic Reactions: Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions
Acids-Bases/Buffer Solution: Different concepts of acids-bases, Buffer solution, Mechanism of buffer solution, Henderson-Hasselbalch equation, Water chemistry and PH of water
Solutions: Solutions and their classification, Unit expressing concentration, Colligative properties and dilute solutions, Raoult's law, Van't Hoff's law of osmotic pressure
Thermochemistry: Laws of thermochemistry, Enthalpy, Hess's law, Heat of formation, Kirchoff's equations, Heat of neutralization, Heat of reaction
Electrochemistry: Conductors & nonconductors, Difference between electrolytic and metallic conduction, Electrolytic conductance, Factors influencing the conductivity of electrolytes, Kohlrausch Law & conductometric titrations
Chemical Equilibria: Equilibrium law/constant, Kp and Kc, Homogeneous and heterogeneous equilibrium, Van't Hoff's reaction isotherm, Le Chatelier's principle
Phase Rule: Basic terms and phase rule derivation, Phase diagram of water and carbon dioxide
Chemical Kinetics: Order and rate of reaction, Pseudo and zero order reaction, Half-life, Determination and factors affecting the rate of a reaction, First order reaction, Second order reaction, Collision theory, Transition state theory

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Define** different basic parameters in the field of inorganic, organic and physical chemistry i.e., atomic structure, periodic table, chemical bonding, acids and bases, chemical equilibrium, thermochemistry and different types of solutions, phase rule etc.	H											
CO2	**Explain** different basic theories in the field of selective organic reactions such as Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions etc.	H											
CO3	**Solve** quantitative problems in the field of inorganic, organic and physical chemistry i.e. solutions, thermochemistry, chemical kinetics, electrical properties of solution etc.	H											
CO4	**Develop** the communication skill by presenting topics on operating systems.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-POa	High	The theory-based knowledge of the natural sciences applicable to the engineering discipline.
CO3-POa	High	The numerical analysis-based knowledge of the natural sciences applicable to the engineering.

CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
		Atomic Structure	
1	Lec 1 Lec 2 Lec 3	Concepts of atomic structure, Different atom models Concepts of atomic structure, Different atom models Quantum numbers, Electronic configuration	Class Test 1
		Atomic Structure/Periodic Table	
2	Lec 4 Lec 5 Lec 6	Hydrogen spectral lines, Heisenberg's uncertainty principle Classification of elements according to electronic configurations Periodic classification of elements	
		Periodic Table/Chemical Bonding	
3	Lec 7 Lec 8 Lec 9	Periodic properties of elements, Properties and uses of noble gases Alkali metals: Chemical properties and uses Chemical bonding (types, properties, Lewis theory, VBT)	
		Chemical Bonding	Class Test 2
4	Lec 10 Lec 11 Lec 12	Molecular orbital theory (MOT) Molecular orbital theory (MOT) Hybridization and shapes of molecules	
		Chemical Bonding/Organic Chemistry	
5	Lec 13 Lec 14 Lec 15	Hybridization and shapes of molecules Hybridization and shapes of molecules Basic concepts of organic chemistry: History, Physical & chemical properties, Classification	
		Organic Chemistry	
6	Lec 16 Lec 17 Lec 18	Chemistry of hydrocarbon, Nomenclature, Properties Selective organic reactions: Oxidation-reduction, Substitution Selective organic reactions: Addition, Polymerization, Alkylation	

		Acids-Bases	
7	Lec 19 Lec 20 Lec 21	Different concepts of acids-bases Buffer solution, Mechanism of buffer solution Henderson-Hasselbalch equation	
		Acids-Bases/Solutions	
8	Lec 22 Lec 23 Lec 24	Water chemistry and pH of water Solutions and their classification, Unit expressing concentration Effect of temperature and pressure on solubility, Validity and limitations of Henry's law	Mid Term Exam
		Solutions/Thermochemistry	
9	Lec 25 Lec 26 Lec 27	Colligative properties and dilute solutions, Raoult's law, deviation from Raoult's law, Elevation of boiling point Freezing point depression, Van't Hoff's law of osmotic pressure Thermochemistry: Laws of thermochemistry, Enthalpy	
		Thermochemistry/Electrochemistry	
10	Lec 28 Lec 29 Lec 30	Hess's law, Kirchoff's equations Heat of formation, Heat of neutralization, Heat of reaction Electrolytic conduction and its mechanism	
		Electrochemistry	
11	Lec 31 Lec 32 Lec 33	Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory Conductrometric titrations Different types of cells	
		Chemical Equilibrium	
12	Lec 34 Lec 35 Lec 36	Reversible reactions, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Units of equilibrium constant Relation between Kp & Kc, Van't Hoff's reaction isotherm Free energy and its significance Heterogeneous equilibrium, Le Chatelier's principle	Class Test 3
		Phase Rule/Chemical Kinetics	
13	Lec 37 Lec 38 Lec 39	Phase Rule: Basic terms and phase rule derivation Phase Diagram of water and carbon dioxide Pseudo and zero order reaction, Half-life	
		Chemical Kinetics	
14	Lec 40 Lec 41 Lec 42	Determination and factors affecting the rate of a reaction First order reaction, Second order reaction Collision theory, Transition state theory	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO2	C2
	Class Attendance	5%	-	-
	Class Performance	5%	CO4	A2
	Mid Term	10%	CO2	C2

			CO3	C3
Final Exam		60%	CO1	C1
			CO2	C2
			CO3	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Modern Inorganic Chemistry – S. Z. Haider
2. Concise Inorganic Chemistry (4^{th}) – J. D. Lee
3. A Textbook of Organic Chemistry(22^{nd}) – Arun Bahl And B. S. Bahl
4. Organic Chemistry (6^{th}) – Morrison and Boyd
5. Principles of Physical Chemistry – Haque and Nawab
6. Essentials of Physical Chemistry – Bahl and Tuli
7. Physical Chemistry – Atkins

REFERENCE SITE

CHEM-102: Chemistry Sessional

COURSE INFORMATION

Course Code	:	CHEM-102	Lecture Contact Hours	: 3.00
Course Title	:	Chemistry Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: CHEM-101
Course Title: Funamentals of Chemistry

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

To implement the basic concepts of inorganic and physical chemistry in a laboratory environment.

OBJECTIVE

1. To familiarize the students with experimentation of acid and base neutralization, titration and quantitative analysis of metals etc.
2. To make students proficient in iodometric and iodometric analysis and complexometric titration etc.
3. To develop students' ability in estimating Copper content in samples by using various titrimetric methods

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to describe the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	C1	-	-	1,2	R, Q, T, F

CO2	Be able to perform experimentation acid-base neutralization regarding iodometric and iodometric method, complexometric titration etc.	C3			1,2	R, Q, T, F
CO3	Be able to measure calcium and copper content in water sample by using various titrimetric methods.	C5			1,2	R, Q, T, F
(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, ASG – Assignment, Pr – Presentation, R – Report, CS – Case study, F – Final Exam)						

COURSE CONTENT

Quantitative chemical analysis in the field of inorganic and physical chemistry such as:
Acid-base titration, Redox titration, Iodometric and Iodometric titration, Complexometric titration.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Be able to describe the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	H											
CO2	Be able to perform experimentation acid-base neutralization regarding iodimetric and iodometric method, complexometric titration etc		H										
CO3	Be able to measure calcium and copper content in water sample by using various titrimetric methods.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	In order to understand different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc., the knowledge of natural science would be required.
CO2-POb	High	In order to perform the experiments, the knowledge of engineering fundamentals is also required.
CO3-POb	High	In order to perform the laboratory task, an ability to design complex process is required.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 07 14 -
Self-Directed Learning Preparation of Lab Reports Preparation for the Lab-test Preparation of Quiz Test	 08 08 08
Formal Assessment Continuous Assessment Final Examination	 07 01
Total	53

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topics
1	Lab 1	Introduction: Safety Instructions; Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution.
2	Lab 2	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate ($CaCl_2.2H_2O$) Solution with Standard Di-Sodium Ethylenediammine Tetraacetic Acid (Na_2EDTA) Solution.
3	Lab 3	Standardization of Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution.
4	Lab 4	Estimation of Copper (Cu) Content in a Copper Sulphate Pentahydrate ($CuSO_4.5H_2O$) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium Thiosulphate Pentahydrate ($Na_2S_2O_3.5H_2O$) Solution.
5	Lab 5	Quiz Test/Practice Lab
6	Lab 6	Final Exam/Viva
7	Lab 7	Final Exam/Viva

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Attendance	10%	CO1, CO3	C1, C2, C6
	Observation	10%		C2
	Lab Report	20%	CO3	C2
Quiz		20%	CO2	C2
Final Evaluation		20%	CO1, CO3	C1, C2, C6

Viva		20%	CO1, CO3	C1, C2, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS
1. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 5th Edition, Longman Scientific & Technical, 1989 2. G. D. Christian., Analytical Chemistry, 6th Edition, Wiley India Pvt. Limited, 2007 3. A. Jabbar Mian and M. Mahbubul Haque-Practical Chemistry
REFERENCE SITE

EECE-163: Electrical Circuit Analysis

COURSE INFORMATION			
Course Code Course Title	: EECE-163 : Electrical Circuit Analysis	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The foundational course on electrical circuits is a basis of making freshmen engineering students well familiarize about the arena of DC and AC circuits. The course is aimed towards the methods of electric circuit analysis and evaluating their responses which can be very well achieved by the understanding of circuit laws, techniques and theorems for both AC and DC excitations. Investigation of first and second order DC circuits is vital in understanding circuit elements like capacitors and inductors used in daily life. A hands-on flavour of the poly phase circuits will enhance the practical knowledge, which addresses the issue of faults and power in the transmission lines. Although the course may seem somewhat rudimentary in its design, it imprints the groundwork for engineers who may pursue advanced course on electrical engineering.
OBJECTIVE
1. **Create** a foundation of basic electrical engineering and circuits. 2. **Familiarize** students with basic circuit laws (Ohm, Kirchhoff), techniques (Mesh, Nodal), concepts (Superposition, Source Transformation) and theorems (Thevenin, Norton). 3. **Develop** the understanding of AC steady state response of single-phase circuits and power in AC circuits. 4. **Introduce** students to poly-phase circuits as a practical arena of AC Circuits.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Interpret** circuit laws and apply their corresponding technique to find electrical circuit quantities; also justify selection particular circuit concept(s) and theorem(s) for simplifying complex circuits.	C2	1	1	K1	T, F
CO2	**Analyze** 1st and 2nd order circuits and evaluate their responses, considering both the presence and absence of direct current (DC) circuits.	C4			K2	T, MT

CO3	**Outline** sinusoids and phasors to **explain** circuit parameters and analyze AC power	C2			K2	F,MT
CO4	**Comprehend** the current voltage relationship in various configurations of three phase circuits and **apply** knowledge of AC power to analyze real life applications.	C3			K3	F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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);**

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Interpret** circuit laws and apply their corresponding technique to find electrical circuit quantities; also justify selection particular circuit concept(s) and theorem(s) for simplifying complex circuits.	H											
CO2	**Analyze** 1st and 2nd order circuits and evaluate their responses, considering both the presence and absence of direct current (DC) circuits.	H											
CO3	**Outline** sinusoids and phasors to explain circuit parameters and analyze AC power	M											
CO4	**Comprehend** the current voltage relationship in various configurations of three phase circuits and **apply** knowledge of AC power to analyze real life applications.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-Poa	High	Problem analysis capability must be present in order to come to circuit solutions.
CO2-POa	High	Fundamental knowledge of capacitor and inductor properties and basic idea of calculus are required to conduct transient and steady-state analysis of first-order and second-order circuits.
CO3-POa	Medium	The knowledge of mathematics, science and electrical engineering sciences has to be applied to describe Sinusoids and phasors along with AC power.
CO4-POc	Medium	Investigative capability is a must in analyzing real life power consumption and faults in transmission lines.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42

Practical / Tutorial / Studio Student-Centred Learning	- -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Charge and Current, Voltage, Power and Energy Circuit Elements, Relevant Practice Problems Ohm's Law; Nodes, Branches and Loops; Kirchhoff's Laws	Class Test 1
2	Lec 4 Lec 5 Lec 6	Series Resistors and Voltage Division, Parallel Resistors and Current Division, Wye-Delta Transformations Nodal Analysis, Nodal Analysis in Circuits with Supernodes Mesh Analysis, Mesh Analysis in Circuits with Supermesh	
3	Lec 7 Lec 8 Lec 9	Nodal and Mesh Analysis problems Superposition Theorem Practice ProblemsRelevant to Superposition Theorem	Class Test 2
4	Lec 10 Lec 11 Lec 12	Thevenin's Theorem Practice ProblemsRelevant to Thevenin's Theorem Norton's Theorem	
5	Lec 13 Lec 14 Lec 15	Practice ProblemsRelevant to Norton's Theorem Electrical Properties of Capacitors, Series and Parallel Capacitors Electrical Properties of Inductors, Series and Parallel Inductors	
6	Lec 16 Lec 17 Lec 18	Source Free RC Circuits Source Free RL Circuits Source Free RLC Circuits	
7	Lec 19 Lec 20 Lec 21	Step Response of a RC Circuit Step Response of a RLCircuit Step Response of a RLC Circuit	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Introduction time varying sinusoid excitations Concept of phasor and complex impedance / admittance Analysis of series and parallel circuits	
9	Lec 25 Lec 26 Lec 27	Network reduction; voltage and current division Basic idea about Source transformation Introduction to Instantaneous power and Average power	
10	Lec 28 Lec 29 Lec 30	Power factor, complex power, power triangle, maximum average power AC power measurement and power conservation. Tie-set and Cut- set schedules	
11	Lec 31 Lec 32 Lec 33	Formulation of equilibrium equations in matrix form Solution of resistive networks	

		Maximum power transfer theorems for variable resistance load	
12	Lec 34 Lec 35 Lec 36	Variable impedance load– Statement and applications Introduction: Graph of a network, Concept of tree and co-tree, incidence matrix Balanced Poly phase Circuits	Class Test 3 or ASG
13	Lec 37 Lec 38 Lec 39	Voltage current relations and power measurement. Unbalanced poly phase circuit Power measurement and faults analysis	
14	Lec 40 Lec 41 Lec 42	Assorted problems on poly phase circuits Practical Applications of Electrical Circuit analysis Summary, Review and Open discussion	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C4
	Class Participation	5%	CO4	C3
	Mid term	10%	CO2, CO3	C2, C4
	Class Attendance	5%	-	-
Final Exam		60%	CO1	C2
			CO3	C2
			CO4	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Fundamentals of Electric Circuit by C. K. Alexander & M. N. Sadiku
2. Introductory Circuit Analysis by R. L. Boylsted
3. Alternating Current Circuits by G. S. Corcoran & R. F. Kerchner
4. Electric Circuits by J. A. Edminister
5. Basic Engineering Circuit Analysis by J. D. Irwin & R. M. Nelms Electric Circuits by James William Nilsson

REFERENCE SITE

EECE-164: Electrical Circuit Analysis Sessional

COURSE INFORMATION

Course Code Course Title	: EECE-164 : Electrical Circuit Analysis Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: EECE 163
Course Title: Electrical Circuit Analysis

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course of electrical engineering discipline aims to familiarize the students with implementation of basic electrical circuits in hardware domain. Designed for fresher students, experiments of this laboratory course will enable them to assemble beginner-level circuits to experimentally verify some fundamental circuit laws and theorems (KVL, KCL, Thevenin, Norton). This course also familiarizes the students with hardware implementation of AC circuits and measurement of ac quantities by oscilloscope. Finally, this course is targeted to introduce the students with hardware projects that will provide them with the first hand on experience about application of electrical engineering in real life and simulation of electrical circuits in a widely used simulation software (Proteus).

OBJECTIVE

1. To enable the students to apply the fundamental circuit laws (KVL, KCL, Ohm's law) in hardware domain.
2. To develop students' skills to simplify complex electrical circuits into simpler circuits by Thevenin and Norton's theorem and verify them in hardware.
3. To teach the students the basic operation of oscilloscope to measure AC quantities (magnitude and phase).
4. To impart the students the skills of analogue filter design by RLC circuit.
5. To familiarize the students with implementation of hardware electrical projects and a circuit simulation software (Proteus)

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Construct** electrical circuits and verify fundamental electrical laws (KVL, KCL and Ohm 's Law) through experimentation and analysis.	P4	1,2	1	1,2,3	R, Q, T
CO2	**Apply** basic network theorems to **analyze** complex circuits and design circuit configurations according to specified requirements	P5, A3			1,2,3	R, Q, T
CO3	**Produce** desired AC waveforms, measure their parameters in oscilloscope and design analog RLC filter circuits.	A2			1,2	R, Q, T
CO4	**Demonstrate** collaborative skills by executing a simple project and engage in group activities to foster teamwork and cooperation.	P7, A4			5	PR, R, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

In this course, students will perform experiments to practically verify the theories and concepts learned in EECE 163 using different hardware equipment and simulation software.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Construct** electrical circuits and verify fundamental electrical laws (KVL, KCL and Ohm's Law) through experimentation and analysis.				H								
CO2	**Apply** basic network theorems to **analyze** complex circuits and design circuit configurations according to specified requirements				H								
CO3	**Produce** desired AC waveforms, measure their parameters in					H							

	oscilloscope and design analog RLC filter circuits.												
CO4	**Demonstrate** collaborative skills by executing a simple project and engage in group activities to foster teamwork and cooperation.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POd	High	Assembling electrical circuits on Hardware level needs thorough investigation of the experiment.
CO2-POd	High	Preparing lab reports on verification of different circuit theorem require documentation and effective report writing skill.
CO3-POe	High	Producing and measuring ac signals and quantities needs knowledge of operation of digital oscilloscope which can be considered a modern engineering tool.
CO4-POi	High	While constructing an electrical circuit for application in real life adapting the desired requirements will be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidiscliplinary settings.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	3
Practical / Tutorial / Studio	7
Student-Centred Learning	11
Self-Directed Learning	
Preparation of Lab Reports	3
Preparation of Lab Test	3
Preparation of presentation	2
Preparation of Quiz	3
Engagement in Group Projects	5
Formal Assessment	
Continuous Assessment	3
Final Examination	1
Total	41

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topic
1,2	Lec 1	Construction and operation of simple electrical circuits
3,4	Lec 2	Verification of KVL and KCL
5,6	Lec 3	Verification of Superposition Theorem and Thevenin's Theorem
7,8	Lec 4	Familiarization with alternating current (ac) waves
9,10	Lec 5	Study of R-L-C series circuit
11.12	Lec 6	Different types of filters and its characteristics with different input frequency
13,14	Lec 7	Lab test, Quiz and Viva

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (75%)	Lab participation and Report	20%	CO1	P4
			CO2	P5, A3
			CO3	A2
			CO4	P7, A4

	Labtest-1, Labtest-2	30%	CO1	P4
			CO2	P5, A3
			CO3	A2
			CO4	P7, A4
	Project and Presentation	25%	CO4	P7, A4
Lab Quiz		25%	CO1	P4
			CO2	P5, A3
			CO3	A2
			CO4	P7, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Fundamentals of Electric Circuit by C. K. Alexander & M. N. Sadiku
2. Introductory Circuit Analysis by R. L. Boylsted
3. Alternating Current Circuits by G. S. Corcoran & R. F. Kerchner
4. Electric Circuits by James William Nilsson Inc.

REFERENCE SITE

GEBS-101: Bangladesh Studies

COURSE INFORMATION

Course Code Course Title	: GEBS-101 : Bangladesh Studies	Lecture Contact Hours Credit Hours	: 2.00 : 2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course has been designed for undergraduate engineering students to help them learn the rich history of Bangladesh, and to provide them with basic knowledge of historical events which eventually led to the formation of Bangladesh and constitution of Bangladesh, current trends in economic development, legislation, citizen charter, cultural aspects which will make them responsible citizens.

OBJECTIVE

1. To equip students with factual knowledge that will enable them to learn the history of Bangladesh.
2. To trace the historical roots of Bangladesh as an independent state focusing on the social, cultural and economic developments that have taken place since its independence.
3. To promote an understanding of the development of Bangladesh and its culture.
4. To create an awareness among the students about the Geography, Economy, Politics and Culture of Bangladesh.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify specific stages of Bangladesh's political history, through the ancient,	C1-C2	-	1	-	T, MT, F

	medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.					
CO2	Explain the economy and patterns of economic changes through qualitative and quantitative analysis.	C2			-	MT, F
CO3	Develop the communication skill by presenting topics on Bangladesh studies.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Midterm Exam)

COURSE CONTENT

Bangladesh Geography: Location, Area, Boundary, Physiography, River system, Forest and Climate, Demography of Bangladesh, Maritime zones; **History:** Overview of the ancient Bengal, anthropological identity of the Bengali race, main trends in the history of medieval Bengal, Bengal under the East India Company, religious and social reform movements, nationalist movements, division of the Indian sub-continent, language movement 1948-1952, education movement of 1962, six-point movement of 1966, mass uprising of 1969, war of independence and emergence of Bangladesh in 1971, Constitution of Bangladesh, Pre and post liberation development in the field of engineering and technology, Bangladesh's contribution to world peace and its security, engineering developments in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc) and its impact on socio-economic aspect;

Environment, Economy and Culture: Land, Characteristics of tropical monsoon climate, Forests and biomass, Fish, Minerals, Health, Education, Agriculture, Industries, NGOs, Population, Sociological and Cultural aspects of Bangladesh, Economy and National development, Development and Progress of the Millennium Development Goals (MDGs), Public Administration in Bangladesh, State of Good Governance in Bangladesh, Art and Literature, Main traditional cultural events, Vision-2021, Digitalization, Tourism and Natural Resources, Bangladesh and International Relations;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.						H						
CO2	Explain the economy and patterns of economic changes through qualitative and quantitative analysis.						H						
CO3	Develop the communication skill by presenting topics on Bangladesh studies.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1- POf	High	In order to identify specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and critically analyse plurality of cultural identities of Bangladesh, application of reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems is required.
CO1- POf	High	In order to explain the economy and patterns of economic changes through qualitative and quantitative analysis, application of reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems is required.

CO3- POj	Medium	Develop communication skills through participating in presentations.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 28 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 28 14 14
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topic	Assessment Methods
1	Lec-1 Lec-2	Introductory class: Brief discussion on the total syllabus, basic requirements of the course, methods of assessment of the course Bangladesh Geography: Location, Area, Boundary, Physiography, River System, Forest and Climate, Demography of Bangladesh.	Class Test-1
2	Lec-3 Lec-4	Overview of the ancient Bengal; anthropological identity of the Bengali race; main trends in the history of medieval Bengal Bengal under the East India Company,	
3	Lec-5 Lec-6	Religious and Social reform movements Nationalist movements, division of the Indian sub-continent	
4	Lec-7 Lec-8	Language movement 1948-1952, Education movement of 1962 Language movement 1948-1952, Education movement of 1962	Mid Term Exam
5	Lec-9 Lec-10	Six-point movement of 1966; Mass uprising of 1969; War of Independence and Emergence of Bangladesh in 1971	
6	Lec-11 Lec-12	Constitution of Bangladesh Constitution of Bangladesh	
7	Lec-13 Lec-14	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	
8	Lec-15 Lec-16	Land, Characteristics of tropical Monsoon climate, Forests and biomass, Fish Engineering development in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc) and its impact on socio-economic aspect	
9	Lec-17 Lec-18	Minerals, Health and Education, Agriculture, Industries	

10	Lec-19 Lec-20	NGOs, Population, Sociological and Cultural aspects of Bangladesh Economy and national development,	Class Test-2
11	Lec-21 Lec-22	Development and Progress of the Millennium Development Goals (MDGs) Public Administration in Bangladesh, State of Good Governance in Bangladesh	
12	Lec-23 Lec-24	Art and Literature Traditional cultural events	
13	Lec-25 Lec-26	Vision-2021, Digitalization Tourism and Natural Resources	
14	Lec-27 Lec-28	Bangladesh and International Relations Revision of the course	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C2
	Presentation	5%	CO3	A2
	Class Attendance	5%	-	-
	Mid term	10%	CO1, CO2	C1-C2
Final Exam		60%	CO1, CO2	C1-C2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Bangladesh Studies: Md. Shamsul Kabir Khan and Daulatunnahar Khanam
2. The Constitution of the People's Republic of Bangladesh
3. Discovery of Bangladesh: Akbar Ali Khan
4. History of Bangladesh, Vols, 1-3: Sirajul Islam
5. History of Modern Bengal, Vol, 1: R C Majumdar
6. Dynastic History of Bengal: Dr. Abdul Mumin Chowdhury
7. A History of Bangladesh: William Van Schendel
8. Geography of Bangladesh: Harun Er Rashid
9. Banglapedia: National Encyclopedia of Bangladesh, Vols, 1-10: Sirajul Islam
10. History of Bengal: (Mughal Period 1526-1765): R. A. Chandra
11. Land of Two Rivers: Nitesh Sengupta
12. A History of Bangladesh: Cambridge University Press
13. Bengali Nationalism and the Emergence of Bangladesh: A.F Salahuddin Ahmed
14. Language Movement and The Making of Bangladesh: Safar Ali Akanda

REFERENCE SITE

MATH-101: Differential and Integral Calculus

COURSE INFORMATION

Course Code Course Title	: MATH-101 : Differential and Integral Calculus	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Purpose of this course is to introduce basic knowledge of Differential Calculus and use it in engineering study.
OBJECTIVE
1. Be able to acquire knowledge on differential and integral calculus to solve engineering problems and other applied problems. 2. Be able to understand the important aspects of rate of change, tangent, normal, area and volume. 3. Be expert in applying knowledge of functional analysis such as increasing, decreasing, maximum and minimum values of a function.
LEARNING OUTCOME & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Define limit, continuity and differentiability of functions, the rate of change of a function with respect to independent variables, the extremum value of functions.	C1	1	-	3	T, F, ASG
CO2	Apply the concepts and techniques of differentiation and integration to solve the problems related to engineering study.	C3			3	T, MT, F
CO3	Calculate length, area, volume and average value related to engineering measurement.	C3			3	MT, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Differential Calculus: Introduction, differential calculus for engineering, continuity and differentiability of functions, differentiation of various functions, successive differentiation, Leibnitz's theorem, Rolle's theorem, Mean-value theorem, expansion of functions, partial differentiation, Euler's theorem, tangent and normal, maxima and minima, curvature, asymptotes.

Integral Calculus: Definition of integration, various techniques of integration, integration by substitution, standard integrals, integration by parts, integration by successive reduction, definite integrals, Walli's formula, integration as a limit of sum, improper integrals, Beta and Gamma functions, multiple integral, lengths of curves, area of the region enclosed by two curves, volume of solid of revolution.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define limit, continuity and differentiability of functions, identify rate of change of a function with respect to independent variables and describe different techniques of evaluating indefinite and definite integrals.	H											

CO2	Apply concepts and techniques of differentiation and integration to solve the problems related to engineering study.	H											
CO3	Calculate length, area, volume, average value related to engineering study.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The knowledge of mathematics, science and engineering has to be applied to describe the complete concept of differential and integral calculus.
CO2-POa	High	To apply proper and improper integral in the field of engineering study, the knowledge of mathematics, science and engineering is required.
CO3-POa	High	In order to calculate volume, average, center of gravity and area of any solid revolution object, the knowledge of mathematics and engineering is needed.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Differential Calculus for Engineering study, Limit of a function and its properties. Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems. Concept of Differentiation, definition, classification of discontinuity and solving problems	Class Test 1
2	Lec 4 Lec 5 Lec 6	Basic concept of Differentiability, definition, derivative of a function, differentiable function. Differentiability – one sided derivative (R.H.D and L.H.D), solving problems Successive differentiation – Concept and problem solving	
3	Lec 7 Lec 8 Lec 9	Leibnitz's theorem and its applications Determination of $(y_n)_0$ Mean Value theorem, Taylor theorem	
4	Lec 10 Lec 11 Lec 12	Taylor theorem Indeterminate forms – concept and problem solving, L'Hospital's rules with application	Class Test 2

5	Lec 13 Lec 14 Lec 15	Partial differentiation - partial derivatives of a function of two variables and problems Partial differentiation - partial derivatives of a homogeneous function of two variables, Euler's theorem for two variables and problems Partial differentiation - partial derivatives of a homogeneous function of several variables, Euler's theorem for several (three and more) variables and problem solving	
6	Lec 16 Lec 17 Lec 18	Tangents and Normals – Tangents and Normals in Cartesian, equation of tangent at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	
7	Lec 19 Lec 20 Lec 21	Maxima and minima of functions of single variables – concept, increasing and decreasing function, Concave up and down with problems Curvature Asymptotes	MID Term
8	Lec 22 Lec 23 Lec 24	Introduction to integral calculus Standard integrals – concept of definite and indefinite integrals, applications. Indefinite integrals – Method of substitution, Techniques of integration	
9	Lec 25 Lec 26 Lec 27	Indefinite integrals – Integration by parts, special types of integration, integration by partial fraction Integration by the method of successive reduction Definite integrals – definite integrals with properties and problems	
10	Lec 31 Lec 32 Lec 33	Definite integrals – Reduction formula, Walli's formula Definite integrals – definite integral as the limit of sum Beta function – concept and problem solving	Class Test 3
11	Lec 28 Lec 29 Lec 30	Gamma function - concept and problem solving Relation between beta and gamma function, Legendre duplication formula, problems and applications Multiple integrals – double integrals	
12	Lec 34 Lec 35 Lec 36	Multiple integrals – triple integrals Multiple integrals – successive integration for two and three variables Arc lengths of curves in Cartesian coordinate	
13	Lec 37 Lec 38 Lec 39	Arc lengths of curves in polar coordinates and parametric curves Area in Cartesian coordinate Area under a plain curve in Cartesian and polar coordinates	
14	Lec 40 Lec 41 Lec 42	Area of a region enclosed by two curves in Cartesian and polar coordinates Volume of solid of revolution Volume of solid of revolution	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
		20%	CO1, CO2	C1, C2

Continuous Assessment (40%)	Class Test/ Assignment 1-3		CO2	C3
			CO3	C3
	Class Attendance	5%	-	-
	Class Performance	5%	CO3	C3
	Mid term	10%	CO2, CO3	C3
Final Exam		60%	CO1	C1
			CO2	C2
			CO3	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT BOOKS

1. Calculus by Howard Anton, Irl C. Bivens, Stephen Davis
2. Differential Calculus (Part I-II) by Dr Md Abdul Matin and Bidhu Bhushan Chakraborty
3. Integral Calculus and Differential Equation by Md Abdul Matin and Bidhu Bhushan Chakraborty

REFERENCE BOOKS

1.Calculus: An Intuitive and Physical Approach by Morris Kline
2.Differential Calculus by B.C. Das and B.N. Mukherjee
3.Integral Calculus by B.C. Das and B.N. Mukherjee

PHY-101: Waves and Oscillations, Optics and Modern Physics

COURSE INFORMATION

Course Code Course Title	: PHY-101 : Waves and Oscillations, Optics and Modern Physics	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course covers the basics of physics in the fields of waves and oscillations, optics, and modern physics. The course will emphasize the basic concepts, theories, and solving quantitative problems that can be applicable in a wide spectrum of engineering disciplines.

OBJECTIVE

1. To define the different parameters, concepts, logical and critical thinking with scientific knowledge of waves and oscillations, optics and modern physics.
2. To explain the basic theories and laws of waves and oscillations, optics and modern physics.
3. To solve numerical and analytical problems regarding waves and oscillations, optics and modern physics.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

CO1	Define different basic laws and parameters in the field of waves and oscillations, optics and modern physics such as simple harmonic motion, damped oscillations, interference, diffraction, polarization, relativity, photoelectric effect, Compton effect, radioactivity, etc.	C1	-	-	1	T, F, MT
CO2	Explain different basic theories in the field of waves and oscillations, optics and modern physics such as the SHM, damped motion, wave motion, interference, diffraction, polarization, special theory of relativity, Compton theory, nuclear transformation, nuclear reaction etc.	C2			1	T, F, MT
CO3	Solve quantitative problems in the field of waves and oscillations, optics and modern physics such as SHM, damped motion, wave motion, interference, diffraction, polarization, relativity, photoelectric effect, Compton shift, radioactivity, etc.	C3			2	T, MT, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Waves and Oscillations: Simple Harmonic Motion (SHM) and its properties, differential equation of a SHM and its solution, total energy and average energy of a body executing SHM, simple pendulum, torsional pendulum, spring-mass system, LC oscillatory circuit, two body oscillation and reduced mass, Composition of SHM, Damped oscillations, and its different condition, forced oscillations and its different condition, resonance, Wave motion : expression for a plane progressive wave, differential equation of wave motion, energy density of wave motion, average kinetic and potential energy of wave motion, Stationary wave.

Optics: Combination of lens, equivalent lens and power, Defects of images and different aberrations, Interference of light, Young's double slit experiment, interference in thin films, Newton's ring, Diffraction of light, Fraunhofer and Fresnel diffraction, diffraction by single slit and double slit, diffraction grating, Fraunhofer diffraction at a circular aperture, resolving power of optical instrument, Polarization of light, Brewster's law, Malus law, polarization by double refraction, Nicole prism, optical activity and polarimeters, Laser: spontaneous and stimulated emission.

Modern physics: Relativity : Frame of reference, postulates of special theory of relativity, Galilean transformation, Lorentz transformation, length contraction, time dilation, velocity addition, relativity of mass, mass energy relation, momentum energy relation, Photoelectric effect, Compton effect, de Broglie matter wave, Bohr atom model and explanation, atomic orbital and energy equation, classification of nuclei, nuclear mass and binding energy, Radioactivity, radioactive decay law, half-life, mean life, nuclear reaction, introduction to nuclear reactor, Basic of Quantum Mechanics and Quantum computing.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Define** the different basic parameters such as periodic motion, interference, diffraction, polarization and prism, photoelectric effect etc.	H											

CO2	**Explain** the wave motion for different systems along with energy, the techniques to derive different formula for interference, diffraction, polarization and prism, different theory regarding modern physics.	H											
CO3	**Solve** quantitative problems in the field of Waves and Oscillations, Optics and Modern physics.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-POa	High	The theory-based knowledge of the natural sciences applicable to the engineering discipline.
CO3-POa	High	The numerical analysis-based knowledge of the natural sciences applicable to the engineering.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course. Periodic motion, oscillatory motion, simple harmonic motion (SHM), properties of SHM, differential equations, general solution of SHM, graphical representation of SHM. Velocity, acceleration, phase and epoch, time period, frequency and angular frequency of SHM	CT-1/ Assignment
2	Lec 4 Lec 5 Lec 6	Total energy and average energy of SHM, problems Simple pendulum, torsional pendulum, spring-mass system. LC oscillatory circuit, two body oscillations, reduced mass	
3	Lec 7 Lec 8 Lec 9	Composition of SHM Composition of SHM, problems Damped oscillations and its differential equation	
4	Lec 10 Lec 11 Lec 12	Displacement equation of damped oscillations and its different conditions, electric damped oscillatory circuit Forced oscillations and its differential equation, displacement equation of forced oscillations, resonance	Class Test 2/ Assignment

		Wave motion: expression for a plane progressive wave, differential equation of wave motion, particle velocity, wave velocity	
5	Lec 13 Lec 14 Lec 15	Energy density of a plane progressive wave, average energy in a plane progressive wave, problems Stationary wave: node, anti-node, problems Lens and combination of lenses, equivalent lens, power of lens, cardinal points	
6	Lec 16 Lec 17 Lec 18	Defects of images and different aberrations Defects of images and different aberrations Interference of light, young's double slit experiment	
7	Lec 19 Lec 20 Lec 21	Analytical treatment of interference, energy distribution Interference fringes, interference in thin films Newton's ring, Interferometer	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Diffraction: Fresnel & Fraunhofer diffraction, diffraction by single slit. Diffraction by double slit, diffraction gratings. Fraunhofer diffraction at a circular aperture, resolving power of optical instrument	
9	Lec 25 Lec 26 Lec 27	Polarization of light, Brewster's law, Malus' law Polarization by double refraction, Nicol prism: Polarizer and analyzer Optical activity: specific rotation, polarimeters	
10	Lec 31 Lec 32 Lec 33	Laser: spontaneous and stimulated emission, applications of laser. Theory of relativity: Frame of reference, postulates of special relativity, Galilean relativity, Galilean transformation. Lorentz transformations, length contraction, time dilation.	
11	Lec 28 Lec 29 Lec 30	Velocity addition, relativistic mass and its expression, Mass and energy equivalence equation and concept of massless particles and its expression, momentum energy relation, problems. Photoelectric effect, photocurrent and work function, kinetic energy, stopping potential	Class Test 3/Assignment
12	Lec 34 Lec 35 Lec 36	Photoelectric equation, characteristics of photoelectric effect. Compton effect: definition, Compton wavelength shift, limitation. De Broglie concept, condition for wave and particle behavior, Bohr atomic model	
13	Lec 37 Lec 38 Lec 39	Expression for Bohr radii and orbital energy for hydrogen atom Classification of nuclei, nuclear mass and nuclear binding energy Radioactivity: Radioactive decay law, half- life	
14	Lec 40 Lec 41 Lec 42	Mean life, nuclear reaction: concept of Fusion, Fission and nuclear chain reaction. General idea on nuclear reactor and nuclear power plant. Basic of Quantum Mechanics and Quantum computing Review of the syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
	Class Test 1-3/	20%	CO1, CO2, CO3	C1, C2, C3

Continuous Assessment (40%)	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1, CO2, CO3	C1, C2, C3
Final Exam		60%	CO1	C1
			CO2	C2
			CO3	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Physics for Engineers : Part-I and Part-II : Dr Giasuddin Ahmad
2. Physics, Volume I and Volume II : Resnick and Halliday
3. Fundamentals of Physics : Halliday, Resnick and Walker
4. Physics for Scientists and Engineers: Serway and Jewett
5. Waves and Oscillations : Brij Lal and Subramannyam
6. The Physics of Vibrations and Waves: H. J. Pain
7. Concept of Modern Physics: Arthur Beiser
8. University Physics with Modern Physics: Hugh D. Young and Roger A. Freedman
9. Modern Physics for Science and Engineering: Marshall L. Burns
10. Modern Physics : B.L. Theraja
11. Fundamental of Optics: Francis A. Jenkins and Harvey E.White
12. Introduction to Modern Optics: Grant R. Fowles
13. Fundamental Optical Design: Michael J. Kidger
14. A Text Book of Optics : Brijlal and N. Subrahmanyam

REFERENCE SITE

PHY-102: Physics Sessional

COURSE INFORMATION

Course Code Course Title	: PHY-102 : Physics Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This is a laboratory course in basic physics in the fields of waves and oscillations, optics, mechanics, electricity, modern physics, and thermal physics. The course will emphasize the fundamental experiments in different fields of physics that can be applicable to a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic physics practically as well as work with a team or individual.

OBJECTIVE

1.To develop basic physics knowledge practically
2.To practice use of basic scientific instrument.

LEARNING OUTCOMES & GENERIC SKILLS						
No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Define the different parameters regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	C1			1	R, Q, F
CO2	Describe the different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	C1			1	R, Q, T, F
CO3	Skilled to Construct Experiments by an individual or by a group to determine different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	C2			2	R, Q, T, F
CO4	Prepare a report for an experimental work.	C2			2	R

(CP – Complex Problems, CA – Complex Activities, KP – Knowledge Profile, T – Test, PR – Project, Q – Quiz, ASG – Assignment, Pr – Presentation, R – Report, CS – Case study, MT- Mid Term Exam, F – Final Exam)

COURSE CONTENT

Quantitative measurement of different parameters in the field of waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics such as:
Specific resistance of materials, high resistance, resistance of a galvanometer, Electrochemical equivalent (ECE) of copper, comparison of the E.M.F's of two cells, radius of curvature, wavelength of light, focal length of lens, specific rotation of sugar, refractive index of a liquid, thermal conductivity of a bad conductor, temperature co-efficient of resistance, pressure co-efficient of a gas, specific heat of a liquid, acceleration due to gravity, spring constant, rigidity modulus, young's modulus, moment of inertia, conservation of linear momentum, frequency of a tuning fork, surface tension, Planck's constant.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define the different parameters regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	H											
CO2	Describe the different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	H											
CO3	Skilled to Construct Experiments by an individual or by a group to determine different phenomena regarding waves and oscillations, optics, mechanics, electricity, modern physics and thermal physics etc.	H											
CO4	Prepare a report for an experimental work.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.

CO2-POa	High	The descriptive knowledge of the natural sciences applicable to the engineering discipline.
CO3-POa	High	Able to do work or complete a task as an individual and as a team.
CO4-POa	High	Capable to write a report on an experimental work.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Experiment	35
Self-Directed Learning	
Preparation of Lab Reports	21
Preparation of Lab-test	13
Preparation of Quiz	9
Preparation of viva	9
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Final viva	1
Final lab exam	3
Total	112

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE

Week	Lab	Topics	
1	Lab 1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, evaluation system of the course, grouping, visit different section of the laboratory, introduction to different basic equipment	
2	Lab 2	Determination of the specific resistance of a wire using meter bridge / Determination of focal length of a concave lens by auxiliary lens method	Perform any one
3	Lab 3	Determination of high resistance by the method of deflection / Determination of resistance of a galvanometer by half deflection method / Determination of specific heat of a liquid by the method of cooling	
4	Lab 4	Determination of ECE of copper by using copper voltameter / Determination of the Young's modulus of bar by bending method / Determination of the Young's modulus for the material of a wire by Searle's apparatus.	
5	Lab 5	Determination of the wavelength of sodium light by a spectrometer using a plane diffraction grating/ Determination of the moment of inertia of a Fly-wheel about its axis of rotation.	
6	Lab 6	Determination of the radius of curvature of a plano-convex lens by Newton's ring method/ Determination of the temperature co-efficient of resistance of the material of a wire using a meter-bridge.	
7	Lab 7	Determination of the specific rotation of sugar by polarimeter/ Determination of the refractive index of a liquid by plane mirror and pin method using a convex lens.	
8	Lab 8	Determination of the thermal conductivity of a bad conductor by Lee's method / Verification of the law of conservation of linear momentum / Determination of the surface tension of water by capillary tube method and hence to verify Jurin's law.	

9	Lab 9	Determination of the value of g acceleration due to gravity by means of a compound pendulum / Comparison of the E.M. F's of two cells by a potentiometer.	
10	Lab 10	Determination of the spring constant, effective mass and the rigidity modulus of the spring / Determination of the pressure co-efficient of a gas at constant volume by constant volume air thermometer.	
11	Lab 11	Determination of the Planck's constant using photoelectric effect / Determination of the frequency of a tuning fork by Melde's experiment	
12	Lab 12	Viva & lab final experimental exam	
13	Lab 13	Viva & lab final experimental exam	
14	Lab 14	Quiz exam	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class performance	10%	-	-
	Report Writing	30%	CO1, CO4	C1, C2
Final Exam (60%)	Lab Test	30%	CO1, CO2, CO3	C1, C2
	Viva	10%		
	Quiz	20%		
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Practical physics for degree students: Dr Giasuddin Ahmad and Md. Sahabuddin
2. Practical Physics: G. L. Squires
3. B.Sc. Practical Physics: C. L Arora
4. Practical Physics: S.L. Gupta and V. Kumar

REFERENCE SITE

LEVEL-1 FALL TERM

CE-150: Engineering Drawing and CAD Sessional

COURSE INFORMATION			
Course Code :	CE-150	Lecture Contact Hours	1.50
Course Title :	Engineering Drawing And CAD Sessional	Credit Hours	0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to give a clear picture of all things in a construction site to an engineering student by drawing different geometric view of landscape and other site details.

OBJECTIVE

1. To understand views of simple objects in free space.
2. To apply the knowledge to draw sectional view, plan view and elevation of various objects and structures by hand and AutoCAD.

LEARNING OUTCOMES & GENERIC SKILLS

<table>
<tr><th>No.</th><th>Course Learning Outcome
(Upon completion of the course, the students will be able to)</th><th>Bloom's Taxonomy</th><th>CP</th><th>CA</th><th>KP</th><th>Assessment Methods</th></tr>
<tr><td>CO1</td><td>Understand 2D and 3D views of simple objects</td><td>C2</td><td rowspan="2">2</td><td rowspan="2">1</td><td>4</td><td>Class Assessment, ASG, Q</td></tr>
<tr><td>CO2</td><td>Apply the knowledge to draw sectional view, plan view and elevation of various objects and structures by hand and AutoCAD.</td><td>C3</td><td>4</td><td>Class Assessment, ASG, Q</td></tr>
</table>

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Engineering Drawing & CAD Sessional Introduction: Lettering, numbering and heading, Instrument and their use;
Geometric view: Sectional views and isometric views of solid geometrical figure, Plan, Elevation and Section of one-story building, Detailed drawing of lattice towers, Use of AutoCAD software;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand 2D and 3D views of simple objects.	H											
CO2	Apply the knowledge to draw sectional view, plan view and elevation of various objects and structures by hand and AutoCAD.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Breadth and depth of knowledge will be achieved through understanding views of different object in 2D and 3D space.
CO2-POb	High	Graduates will able compare between different elevations of objects through applying drawing knowledge of CAD.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	12
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Assignment Preparation	24
Revision	-
Assessment Preparations	03
Formal Assessment	
Quiz	2
Viva	1
Class Performance	18
Total	60

TEACHING METHODOLOGY

Power point presentation, white board, References and lecture notes.

COURSE SCHEDULE

Week	Lecture	Topics	Rmks
1	Lab-1	An overview on engineering drawing, Various instruments and their use, Scale &measurement, Concept of 3D view, Difference between perspective, oblique & isometric view, concept of isometric &orthographic view, home assignment.	
2	Lab-2	Practice orthographic view and problem solving	
3	Lab-3	Class assessment, drawing orthographic from isometric and isometric from orthographic.	
4	Lab-4	AutoCad Tools	
5	Lab-5	AutoCad Tools	
6	Lab-6	AutoCad Tools + Isometric Views	
7	Lab-7	AutoCad Orthographic + Sectional views	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Quiz	20%	CO1	C1
			CO2	C2
	Class Participation	10%	CO1	C1
	Assignment/ Report	30%	CO2	C2
Lab Test		40%	CO1	C1
			CO2	C2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Civil Engineering Drawing by - Gurcharan Singh &Subash Chandra
2. Prathomic Engineering Drawing by - Hamonto Kumar Bhottacharjo
3. Engineering Drawing by Basant Agrawal and C M Agrawal

REFERENCE SITE

CSE-103: Digital Logic Design

COURSE INFORMATION

Course Code Course Title	: CSE-103 : Digital Logic Design	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to learn about different logic gates, to design and analysis of digital circuits, 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 boolean algebra theorems and apply them for simplifying logic functions.
2. To understand Karnaugh map and other methods to perform an algorithmic reduction of multivariable logic functions.
3. To understand the usefulness of combinational circuits: adder, subtractor, code converters encoders/decoders, multiplexers, de-multiplexers, ROM, RAM, PLAs.
4. To design and analysis of clocked sequential circuits, flip-flops, state diagram, state table, different latches.
5. To understand the analysis of various registers, shift-registers, counters and how more complex systems are constructed.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

	(Upon completion of the course, the students will be able to)					
CO1	Remember and understand the number system and Boolean algebra and basic properties of Boolean algebra to simplify simple Boolean functions.	C1	1	-	1, 2	T
CO2	Understanding combinational circuits and applying the tabulation and Karnaugh map methods for simplifying them.	C2, C3			1,3	T, MT, F
CO3	Identify the basic sequential logic components: SR Latch, Different Flip-Flops and their usage and able to analyze sequential logic circuits.	C2-C4			1,3	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT-Mid Term Exam)

COURSE CONTENT

Binary Systems: Number systems, complements and codes; **Digital and Boolean logic design:** Boolean algebra, De-Morgan`s theorems, logic gates and their truth tables, canonical forms, combinational logic circuits, minimization techniques; **Simplification of Boolean Functions:** The Map Methods, Product of sum simplification, the NAND, NOR implementation, the tabulation method, the don't care implementation; **Combinational Logic:** Arithmetic and data handling logic circuits, decoders and encoders, multiplexers and de-multiplexers; **Sequential Logic:** Flip-flops, Counters, asynchronous counters, synchronous counters and their applications,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; **Registers, Counters and the memory Unit:** Registers and basic memory unit, Shaft registers, Ripple counters, synchronous counters.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Remember and understand the number system and Boolean algebra and basic properties of Boolean algebra to simplify simple Boolean functions.	H											
CO2	Understanding combinational circuits and applying the tabulation and Karnaugh map methods for simplifying them.		H										
CO3	Identify the basic sequential logic components: SR Latch, Different Flip-Flops and their usage and able to analyze sequential logic circuits.	H											

(H–High, M–Medium, L–Low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Applying the knowledge of different number systems, postulates and theorems of boolean algebra to the solution Boolean functions.
CO2-POb	High	To simplify the Boolean functions and truth table and other digital circuits, need to understand which map or postulates to apply to get the best result.
CO3-POa	High	To solve digital circuits, need to know and analyze which components like flip-flops, encoder/decoder, multiplexer, PLA, counter etc will be better.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)

Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Number Systems, Components and codes	Class Test 1
2	Lec 4 Lec 5 Lec 6	Digital Logic, Boolean algebra and 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 Lec 18	Decoders and encoders, multiplexers and de-multiplexers	
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	Mid Term Exam
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 3
12	Lec 34 Lec 35 Lec 36	Mealy and Moor machines; State minimizations and assignments	
13	Lec 37 Lec 38	Pulse mode logic; Fundamental mode design	

	Lec 39		
14	Lec 40 Lec 41 Lec 42	PLA design using MSI and LSI components	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2, P3, A1
			CO2	C2, C3
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid Term	10%	CO3	C2-C4
Final Exam		60%	CO3	C2-C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

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

CSE-104: Digital Logic Design Sessional

COURSE INFORMATION

Course Code	:	CSE-104	Lecture Contact Hours	3.00
Course Title	:	Digital Logic Design Sessional	Credit Hours	1.50

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course aims to provide students with 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

3. To gain basic knowledge on logic design and the basic building blocks used in digital systems, in particular digital computers.
4. To design different types of combinational and sequential logic circuit and their implementations.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Operate laboratory equipment by implementing and simulating simple combinational digital circuits.	C2, A2			-	LT
CO2	Analyse a given problem and apply the acquired knowledge to design both combinational and sequential circuits.	C3-C5	1	1, 3	5	Viva, Q, LT, R
CO3	Understand the relationship between abstract logic characterizations and practical implementations while designing a system.	C4-C6			5	Viva, LT, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Boolean and Logic gates: Logic gates and their truth tables, canonical forms, combinational logic circuits, minimization techniques; **Combinational Circuits:** Arithmetic and data handling logic circuits, Adder, Subtractor, Comparator decoders and encoders, multiplexers and de-multiplexers; **Sequential Circuits:** Flip-flops, race around problems; **Counters**: Asynchronous counters, synchronous counters and their applications; **Memory:** Registers and basic memory unit; **Logic Design:** Synchronous and asynchronous logic design; **Design of sequential circuit:** State diagram; State minimizations and assignments.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Operate laboratory equipment by implementing and simulating simple combinational digital circuits.	H											
CO2	Analyse a given problem and apply the acquired knowledge to design both combinational and sequential circuits.		H										
CO3	Understand the relationship between abstract logic characterizations and practical implementations while designing a system. .		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Able to apply knowledge of different number systems, postulates and theorems of boolean algebra to simplify and design digital circuits.
CO2-POb	High	Able to analyze a given problem and solving the problem by implementing different basic gates.

CO3-POb	High	Able to analyze and implement a complete combinational/sequential digital circuit using different gates and ICs.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Student-Centred Learning	-
Self-Directed Learning	
Report	14
Revision	-
Assessment Preparations	02
Formal Assessment	
Lab Test	3x2=6
Total	64

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Rmks
1	Lab 1	Verify Basic Logic Gates and Truth Tables of the Logic Gates	
2	Lab 2	Combinational Circuit (Light Your Lamp)	
3	Lab 3	Experiments Based on Truth tables and Boolean functions	
4	Lab 4	Experiments Based on Truth tables and K-maps	
5	Lab 5	Design and implementation of the Logic Circuits using K-maps (7 Segment Display)	
6	Lab 6	Experiments Based on Adder/Subtractor	
7	Lab 7	Experiment based on real life examples	
8	Lab 8	Experiments Based on Comparator	
9	Lab 9	Design and implementation of Combinational circuit using Multiplexer	
10	Lab 10	Design and Implementation of encoder and decoder	
11	Lab 11	Design and implement Flip Flop using basic gates	
12	Lab 12	Design and implement counters using Flip-Flops	
13	Lab 13	Design and implement counters, registers using Flip-Flops	
14	Lab 14	Experiments based on real life example	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy

Lab Test	40%	CO2	C3-C5
		CO3	C4-C6
		CO1	C2, A2
Quiz	20%	CO2	C3-C5
Viva	10%	CO2	C3-C5
		CO3	C4-C6
Class Performance	20%	CO2	C3-C5
		CO3	C4-C6
		CO1	C2, A2
Report	10%	CO2	C3-C5
		CO3	C4-C6
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

4. Digital Logic and Computer Design by M. Morris Manno
5. Digital Computer Electronics by Albert P. Malvino, Jerald A Brown

REFERENCE SITE

CSE-105: Structured Programming Language

COURSE INFORMATION

Course Code	: CSE-105	Lecture Contact Hours	3.00
Course Title	: Structured Programming Laguage	Credit Hours	3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Structured Programming Language course is designed to introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to program design and development. The course begins with introductory concepts of structured programming language and then covers other important topics related to structured programming language.

OBJECTIVE

1. To describe algorithms and solve problems using computers.
2. To know about various syntax, semantics of structured programming languages.
3. To develop basic programming skills with respect to program design and development.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Describe algorithm and solve problems using computer programs.	C1-C3	-	-	1	T, F, MT

CO2	Analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.	C4			2	T, F, MT
CO3	Develop basic programming skills with respect to program design and development.	C6			5	T, F, MT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to computer programming: Programming Concepts, Program Development Stages, Structured Programming Language; **Number System:** binary, octal, decimal and hexadecimal systems, number representation; **Basic programming Structures:** Data types and their memory allocation, Operators (includes bitwise operators), Expressions, Basic Input/output; **Control Structure:** "if else", "switch", Flow Charts, Loop, Nested Loop; **Arrays:** One-dimensional array, Multi-dimensional array, Character array/ string; **Function:** Function definition, Function declaration, Function call, Recursion**; Pointer:** Different types of pointers, Pass pointer as arguments, Call by value vs call by reference; **Dynamic Memory Allocation:** Malloc, Calloc, Free, Realloc; **User defined data types:** Structures, Unions, Enumerations; **File I/O:** Read write append from files; **Header file and Preprocessors:** Header files, Preprocessor; **Error Handling:** Exception handling;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Describe algorithm and solve problems using computer programs.	H											
CO2	Analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.		H										
CO3	Develop basic programming skills with respect to program design and development.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	In order to solve programming problems, knowledge of computer programming steps, algorithms and computer usage is very important.
CO2-POb	High	To analyse the structure programming language one needs to analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.
CO3-POc	High	To design and develop solutions for scenario-based problems, one needs to develop basic programming skills.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)

Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

<table>
<tr><th>Week</th><th>Lecture</th><th>Topics</th><th>Assessment Methods</th></tr>
<tr><td rowspan="3">1</td><td>Lec 1</td><td rowspan="3">Programming Concepts, Program Development Stages, Structured Programming Language</td><td rowspan="9">Class Test 1</td></tr>
<tr><td>Lec 2</td></tr>
<tr><td>Lec 3</td></tr>
<tr><td rowspan="3">2</td><td>Lec 4</td><td rowspan="3">Number System: binary, octal, decimal and hexadecimal systems, number representation; Data types and their memory allocation</td></tr>
<tr><td>Lec 5</td></tr>
<tr><td>Lec 6</td></tr>
<tr><td rowspan="3">3</td><td>Lec 7</td><td rowspan="3">Operators, expressions, Basic Input/output; Control Structure: “if else”, “switch”, Flow Charts</td></tr>
<tr><td>Lec 8</td></tr>
<tr><td>Lec 9</td></tr>
<tr><td rowspan="3">4</td><td>Lec 10</td><td rowspan="3">Control Structures: Loop</td><td rowspan="9">Class Test 2</td></tr>
<tr><td>Lec 11</td></tr>
<tr><td>Lec 12</td></tr>
<tr><td rowspan="3">5</td><td>Lec 13</td><td rowspan="3">Control Structures: Nested Loop
One-dimensional array, Multi-dimensional array
Character array/ String</td></tr>
<tr><td>Lec 14</td></tr>
<tr><td>Lec 15</td></tr>
<tr><td rowspan="3">6</td><td>Lec 16</td><td rowspan="3">Function definition, function declaration, function call
Different types of pointers, pass pointer as arguments, call by value vs call by reference
Dynamic Memory Allocation: Malloc, calloc, realloc, free</td></tr>
<tr><td>Lec 17</td></tr>
<tr><td>Lec 18</td></tr>
<tr><td rowspan="3">7</td><td>Lec 19</td><td rowspan="3">Recursion
Structures, unions, enumerations.
File I/O; Header files, Preprocessor</td><td rowspan="4">Mid Term Exam</td></tr>
<tr><td>Lec 20</td></tr>
<tr><td>Lec 21</td></tr>
<tr><td>8</td><td>Lec 22</td><td>Error Handling;</td></tr>
</table>

	Lec 23	Control Structures: Nested Loop One-dimensional array, Multi-dimensional array	
	Lec 24		
9	Lec 25	Character array/ String Function definition, function declaration, function call Different types of pointers, pass pointer as arguments, call by value vs call by reference	
	Lec 26		
	Lec 27		
10	Lec 28	Dynamic Memory Allocation: Malloc, calloc, realloc, free Recursion Structures, unions, enumerations.	
	Lec 29		
	Lec 30		
11	Lec 31	File I/O; Header files, Preprocessor Control Structures: Nested Loop	Class Test 3
	Lec 32		
	Lec 33		
12	Lec 34	One-dimensional array, Multi-dimensional array Character array/ String Function definition, function declaration, function call	
	Lec 35		
	Lec 36		
13	Lec 37	Different types of pointers, pass pointer as arguments, call by value vs call by reference Dynamic Memory Allocation: Malloc, calloc, realloc, free Recursion	
	Lec 38		
	Lec 39		
14	Lec 40	Structures, unions, enumerations.	
	Lec 41		
	Lec 42		

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C4
	Class Attendance	5%	-	-
	Class Participation	5%	CO2	C4
	Mid term	10%	CO2	C4
Final Exam		60%	CO2	C4
			CO3	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Teach Yourself C (3rd Edition) by Herbert Schidlt
2. Programming in Ansi C (6th Edition) by E Balagurusamy

3. C: The Complete Reference (4th Edition) by Herbert Schildt
REFERENCE SITE

CSE-106: Structured Programming Language Sessional

COURSE INFORMATION			
Course Code	: CSE 106	Lecture Contact Hours	: 3.00
Course Title	: Structured programming Language Sessional	Credit Hours	: 1.50

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The Structured Programming Language Sessional course is designed to practically introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to program design and development. The lab begins with practicing introductory concepts of structured programming language and then covers other important topics related to structured programming language.
OBJECTIVE
1. To learn basic ideas 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.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop the communication skill by presenting a group project on Structured programming Language.	A2	-	-	-	PR, Pr, R
CO2	Analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language practically.	C4			7	T, ASG, Q
CO3	Apply practical knowledge to develop basic programming skills by designing and developing computer programs for real life context.	-			7	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Basic programming Structures: Mathematical problems using printf, scanf, Data types and their memory allocation, Operators, Expressions, Basic Input/output, Data type conversion; **Control Structure:** Practice problems on “if else”, “switch”, Flow Charts, Loop, Nested Loop; **Arrays:** Practice problems on One-dimensional array, Multi-dimensional array, Character array/ string;

Function: Practice problems on Function, Parameter Passing Convention; **Recursion:** Practice problems on recursion**; Pointer:** Practice problems on Different types of pointers, Pass pointer as arguments, Call by value vs call by reference; **Dynamic Memory Allocation:** Dynamically allocate memory using Malloc, Calloc, Free, Realloc; **User defined data types:** Practice problems on Structures, Unions, Enumerations; **File I/O:** Read, write, append in file; **Header Files and Preprocessors:** Header files, Preprocessor; **Error Handling:** Exception handling;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop the communication skill by presenting a group project on Structured programming Language.										L		
CO2	Analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language practically.	H											
CO3	Apply practical knowledge to develop basic programming skills by designing and developing computer programs for real life context.						H						

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1- POj	Low	In order to give a presentation on a selective project we need strong communication skills.
CO2 – POa	High	In order to apply knowledge of engineering fundamentals, one needs to analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.
CO3 – POf	High	In order to apply reasoning and take responsibilities relevant to the professional engineering practice, apply practical knowledge to develop basic programming skills with respect to program design and development for real life context.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Student-Centered Learning	-
Self-Directed Learning	
Preparation of Lab Reports	-
Preparation for the Lab-test	-
Preparation of Quiz Test	-
Formal Assessment	

Continuous Assessment	04
Final Examination	03
Total	49

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1	Lab 1	Mathematical problems using printf, scanf
2	Lab 2	Introduction to data types, mathematical problems using data types, data type conversion
3	Lab 3	Practice Problems on “if else”, “else if”, “switch”
4	Lab 4	Practice Problems on Nested “if else”
5	Lab 5	Practice Problems on Problem on Loop- For, Do While, Nested Loop
6	Lab 6	Practice Problems on Nested Loop, One-dimensional array
7	Lab 7	Practice Problems on Multi-dimensional array
8	Lab 8	Practice Problems on Nested Loop, Character array/String
9	Lab 9	Practice Problems on Function, Parameter Passing Convention
10	Lab 10	Practice problems on Different types of pointers, pass pointer as arguments, dynamically allocate memory using calloc, malloc, free, realloc
11	Lab 11	Practice problem on Recursion
12	Lab 12	Practice problem on User Defined Data Types: Structure, Union
13	Lab 13	File I/O and Error Handling
14	Lab 14	Project Presentation

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO2	C4
	Class Performance	5%	CO2	C4
	Project	15%	CO1	A1
Online Test-1		20%	CO3	C3, C6
			CO3	C3, C6
Online Test-2		20%	CO3	C3, C6
			CO3	C3, C6
Viva/ Quiz		20%	CO2	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Teach Yourself C (3rd Edition) by Herbert Schildt
2. Programming in Ansi C (6th Edition) by E Balagurusamy
3. C: The Complete Reference (4th Edition) by Herbert Schildt

4. C Programming Language (2nd Edition) by Dennis M. Ritche
REFERENCE SITE

EECE-169: Electronic Devices and Circuits

COURSE INFORMATION			
Course Code Course Title	: EECE-169 : Electronic Devices and Circuits	Lecture Contact Hours Credit Hours	: 3.00 : 3.00
PRE-REQUISITE			
Course Code: EECE 163 Course Title: Electrical Circuit Analysis			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
RATIONALE			
This subject is classified under the applied technology group and is strongly intended to teach the students the concepts, principles and working of basic electronic components and their implementations on 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 be able to understand the basics of electronic devices like diode, Transistor, MOSFET etc and their applications. 2. To be able to differentiate between the working principal of different electronic components. 3. To become skilled at designing different electronic circuits like rectifier, amplifiers etc. 4. To apply theoretical knowledge for solving complex mathematical problems.			

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Explain** the basic operation of diodes, transistors, Op-Amp, oscillators, TRIAC, DIAC and their characteristics to solve engineering problems.	C2	-	-	1,3	T, MT
CO2	**Compare** the characteristics of different types of diodes, transistors, OP-Amp and oscillators.	C3			1	T, MT, F
CO3	**Analyze** mathematical problems based on electronic circuits to meet specific design criteria.	C3			2,5	F, ASC
CO4	**Apply** the knowledge of semiconductor diodes, transistors, Op-Amp etc to solve real life engineering problems such as rectification, switching and amplification.	C5			3	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to semiconductors: p type and n type semiconductors, p-n junction diode characteristics.

Diode applications: Half and full wave rectifiers, clipping and clamping circuits, regulated power supply using Zener diode.
Bipolar Junction Transistor (BJT): Principle of operation, I-V characteristics, transistor circuit configurations (CE, CB, CC), BJT biasing, load lines, BJTs at low frequencies, hybrid model- h parameters, simplified hybrid model, small signal analysis of single and multi-stage amplifiers, frequency response of BJT amplifiers.
Field Effect Transistor (FET): Principle of operation of JFET and MOSFET, depletion and enhancement type NMOS and PMOS, biasing of FETs, low and high frequency models of FETs, switching circuits using FETs, introduction to CMOS.
Operational Amplifiers (OP-AMPS): Linear applications of OPAMPs, gain, input and output impedances; active filters, frequency response and noise.
Introduction to oscillators SCR, TRIAC, DIAC and UJT: Characteristics and applications, Introduction to IC fabrication processes.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Explain** the basic operation of diodes, transistors, Op-Amp, oscillators, TRIAC, DIAC and their characteristics to solve engineering problems.	H											
CO2	**Compare** the characteristics of different types of diodes, transistors, OP-Amp and oscillators.	H											
CO3	**Analyze** mathematical problems based on electronic circuits to meet specific design criteria.			H									
CO4	**Apply** the knowledge of semiconductor diodes, transistors, Op-Amp etc to solve real life engineering problems such as rectification, switching and amplification.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Basic of fundamental engineering relates to the basic operations of various electronic components.
CO2-POb	High	To identify the problems with research literature and reaching a solution will be needed to create comparison among some of their working principle.
CO3-POc	High	To solve various mathematical problems to meet specific criteria will help designing and developing solutions.
CO4-POc	Medium	The skill of designing and developing solutions is needed to apply the knowledge and solve real life problems.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3

Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2 Lec 3	Basic ideas and example about Electronics comparison between electronic and electrical equipment and their application Introduction to semiconductor devices and its classifications	Class Test 1
2	Lec 4 Lec 5 Lec 6	P-type and N-type materials and doping Semiconductor diode and its band diagram Biasing of semiconductor diodes	
3	Lec 7 Lec 8 Lec 9	I-V characteristics of diode and equivalent circuit of diodes, Shockley's equation Zener diode and related math Applications of diode	
4	Lec 10 Lec 11 Lec 12	Diode rectifiers Ripple factor and related mathematical problems. Clipper circuit and related problems	Class Test 2
5	Lec 13 Lec 14 Lec 15	Clamper circuit and related problems Diodes in voltage multiplier circuit Voltage doubler, Tripler and quadrupler circuit	
6	Lec 16 Lec 17 Lec 18	Introduction to BJT and construction Working principle, operating regions of BJT BJT configurations and characteristics curves	
7	Lec 19 Lec 20 Lec 21	BJT Biasing circuits, BJT as an amplifier, biasing the BJT for discrete circuits Small signal equivalent circuit models BJT as a switch and mathematical problems	
8	Lec 22 Lec 23 Lec 24	Introduction to FET and comparative studies between BJT and FET Construction and operation of JFET Mathematical problems related to JFET	Mid term Exam
9	Lec 25 Lec 26 Lec 27	Small signal analysis of JFET Mathematical problems Mathematical problems	
10	Lec 28 Lec 29 Lec 30	Introduction to MOSFET, Construction and operating principle Types and Characteristics curve of MOSFET Biasing of MOSFET and related problems	
11	Lec 31 Lec 32 Lec 33	Threshold voltage, Body effect, current-voltage characteristics of enhancement MOSFET Single-stage MOSFET, multi stage MOSFET and application of MOSFET as switch. Introduction to CMOS circuits	
12	Lec 34 Lec 35 Lec 36	Basics of Operational Amplifier. Different types of operational amplifier and introduction to Filters Mathematical problems related to op-amp	Class Test 3
13	Lec 37 Lec 38 Lec 39	Basic Principle of oscillation Different type of oscillators Mathematical problems	
14	Lec 40 Lec 41 Lec 42	Concepts of negative feedback Characteristics and applications of SCR, TRIAC, DIAC and UJT Review class	

ASSESSMENT STRATEGY				
Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C3
	Class Participation	5%	-	-
	Mid term	10%	CO1	C2
			CO2	C3
	Attendance	5%	-	-
Final Exam		60%	CO2	C3
			CO3	C3
			CO4	C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Electronic Devices and Circuit Theory -Robert L. Boylestad and Louis Nashelsky
2. Electronic Principles – Albert P. Malvino.
3. Microelectronics 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: Electronic Devices and Circuits Sessional

COURSE INFORMATION

Course Code Course Title	: EECE-170 : Electronic Devices and Circuits Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: EECE 169
Course Title: Electronic Devices and Circuits

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Electronics Devices and Circuits Sessional course is designed to familiarize the students with some basic electronic components and to examine the characteristics and working of these components in electronic devices and circuits by hand-held experiments and computer aided simulation tool. After being acquainted with these basic components, students will be able to apply the achieved knowledge to implement electronic devices to perform different mathematical operations and to design oscillator circuits for practical purpose.

OBJECTIVE

1. To enable the students to implement circuits using different electronic components like diode, BJT and JFET and analyze working principles and input/output characteristics of these components.
2. To provide the students ability to implement electronic circuits like rectifier, OP-AMP circuits to perform different mathematical operations and oscillator circuits for applications in real life engineering.

3. To introduce the students with the use of circuit simulation software PSpice Schematics in analyzing electronic circuits and thereby enrich their skills in designing various complex electronic circuits.
4. To augment student's creative thinking, communication and project management skills through projects and presentations.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Analyze** the characteristics of various types of active and passive electronic components by constructing simple circuits using these elements	P2, P5	1	-	3	R, Q, T
CO2	**Construct** basic electronic devices to perform rectification, amplification and various mathematical operations.	P4			2, 3, 5, 6	R, Q, T
CO3	**Design** and **build** electronic device for real life application adapting the desired requirements.	P5			3, 5, 6	PR, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

In this course, students will perform experiments to practically verify the theories and concepts learned in EECE 169 using different hardware equipment and simulation software.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Analyze** the characteristics of various types of active and passive electronic components by constructing simple circuits using these elements					H							
CO2	**Construct** basic electronic devices to perform rectification, amplification and various mathematical operations.					H							
CO3	**Design** and **build** electronic device for real life application adapting the desired requirements.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POe	High	Knowledge of the engineering fundamentals is needed to construct simple electronic circuits using various types of electronic components (diode, BJT, JFET) and to analyze the characteristics of these components to create, select and apply appropriate techniques.
CO2-POe	High	Modern simulation tools will be used for verifying the operation of oscillator and mathematical operations performing circuits.
CO3-POi	High	While constructing an electronic device for application in real life adapting the desired requirements will be able to function effectively as an individual, and as a member or leader in diverse teams, and in multidiscliplinary settings.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	

Lecture	7
Experiment	14
Self-Directed Learning	
Preparations of Lab Report	15
Preparation of Lab-Test	2
Preparation of Quiz	2
Preparation of Presentation	5
Engagement in Group Projects	12
Formal Assessment	
Continuous Assessment	10
Final Quiz	1
Total	68

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE

Week	**Lecture**	Topics
1,2	Lec 1	Study of Diode Characteristics using Hardware implementation and simulation in PSpice Schematics
3,4	Lec 2	Implementation of Diode Rectifier Circuits and study their rectification characteristics using Hardware implementation and simulation in PSpice Schematics.
5,6	Lec 3	Construction of n-p-n CE (common emitter) and CB (common base) transistor and determine their input and output characteristics using Hardware implementation and simulation in PSpice Schematic.
7,8	Lec 4	Study of Characteristics of Junction Field Effect Transistor (JFET) using Hardware implementation and simulation in PSpice Schematic.
9,10	Lec 5	Mathematical operations using OP-AMP (Adder and Subtractor) using hardware implementation and simulation in PSpice Schematic.
11,12	Lec 6	Mathematical operations using OP-AMP (Integrator and Differentiator) using hardware implementation and simulation in PSpice Schematic.
13,14	Lec 7	Lab Test, lab quiz and viva

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab participation and Report	20%	CO1	P4, C4
			CO2	P1, P4
	Labtest-1, Labtest-2	30%	CO1	P4, C4
			CO2	P1, P4
	Project and Presentation	25%	CO3	P5, P6
			CO4	A5
Lab Quiz		25%	CO1	P4, C4
			CO2	P1, P4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

LANG-102: Communicative English - 1

COURSE INFORMATION			
Course Code Course Title	: LANG-102 : Communicative English - 1	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course has mainly been designed to improve speaking and oral communication skills of the students. The course includes instructions and experience in speech preparation and speech delivery within various real life situations, formal and informal. Emphasis will be given on various speeches, such as informative, persuasive and interactive.
OBJECTIVE
1. To develop English language skills to communicate effectively and professionally. 2. To strengthen students' presentation skills. 3. To develop competency in academic reading and writing.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Understand** the techniques of academic reading and become familiar with technical terms and develop competency in academic reading, preparing report written communication/ presentation.	C2	1	-	1	ASG, Q
CO2	**Analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions.	C3			1	ASG/ Pr, Q
CO3	**Communicate effectively** within the shortest possible time to present their reports and academic writings	C4			1	Pr, Q
CO4	**Apply** the techniques to find out the main points of any long article within a very limited time as well as know the techniques of any effective writing.	C5			1	ASG/ Pr, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Speaking: Introduction to Language: Introducing basic skills of language, English for Science and Technology, Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd, Asking and giving directions, Discussing everyday routines and habits, Making requests /offers /invitations /excuses /apologies/complaints, Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event, Practicing storytelling, Narrating personal experiences/Anecdotes, Telephone conversations (role play in group or pair), Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation); **Listening:** Listening and understanding: Listening, note taking and answering questions; Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand**;** Listening to short conversations between two persons/more than two**; Reading:** Reading techniques: scanning, skimming, predicting, inference; Reading Techniques: analysis, summarizing and interpretation of texts**; 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, Advanced vocabulary preparation, Analytical and technical/scientific writing.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)									
		a	b	c	d	e	f	g	h	i	j
CO1	**Understand** the techniques of academic reading and become familiar with technical terms and develop competency in academic reading, preparing report written communication/ presentation.	H									
CO2	**Analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions.	H									
CO3	**Communicate effectively** within the shortest possible time to present their reports and academic writings										M
CO4	**Apply** the techniques to find out the main points of any long article within a very limited time as well as know the techniques of any effective writing.										L

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	In order to listen, understand, and learn the techniques of note taking and answering questions, the knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems is to applied.
CO2-POa	High	In order to listen, understand, and learn the techniques of note taking and answering questions, identification, formulation, research literature and analysis of complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences are required.
CO3-POj	Medium	In order to communicate effectively within the shortest possible time to present their ideas and opinions, it is required to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
CO4-POj	Low	In order to develop competency in reading, writing and oral communication/presentation, it is required to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation,

		make effective presentations, and give and receive clear instructions.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 42 42
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - -
Formal Assessment Continuous Assessment Final Examination	 4
Total	88

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topic
1	Lab 1	Introduction to Language, Self-introduction and introducing others Self-introduction and introducing others
2	Lab 2	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
3	Lab 3	Discussing everyday routines and habits, Making requests/offers/invitations/excuses/apologies/complaints
4	Lab 4	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event
5	Lab 5	Practicing storytelling, Narrating personal experiences/Anecdotes
6	Lab 6	Telephone conversations (role play in group or pair), Situational talks / dialogues
7	Lab 7	Listening and understanding: Listening, note taking and answering questions
8	Lab 8	British and American accents, documentaries from BBC and CNN will be shown and students will try to understand
9	Lab 9	Listening to short conversations between two persons/more than two
10	Lab 10	Reading techniques: scanning, skimming, predicting, inference;
11	Lab 11	Reading Techniques: analysis, summarizing and interpretation of texts
12	Lab 12	Introductory discussion on writing, prewriting, drafting
13	Lab 13	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event
14	Lab 14	Paragraph writing, Compare-contrast and cause- effect paragraph

ASSESSMENT STRATEGY

Components		**Grading**	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Participation	20%	CO1, CO2, CO4	C2, C3, C5
	Reading Test	15%	CO1, CO2, CO4	C2, C3, C5
	Listening Test	15%	CO1, CO3, CO4	C2, C4, C5
	Public Speaking	20%	CO2, CO3, CO4	C3-C5
Group Presentation		30%	CO1-CO4	C2-C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)
REFERENCE BOOKS
1. Langan, J. (2005). College Writing Skills with Readings (6^{th}). McGraw-Hill Publication 2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication 3. Jones, L. (1981). Functions of English. (Student's Book, 2^{nd}) Melbourne, Australia: Cambridge University Press. 4. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation) 5. From Paragraph to Essay - Maurice Imhoof and Herman Hudson 6. Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd. 7. Speak like Churchill stand like Lincoln - James C. Humes 8. Cambridge IELTS Practice Book 9. Selected Sample Reports and Selected Research Articles
REFERENCE SITE

MATH-105: Vector Analysis, Matrix and Coordinate Geometry

COURSE INFORMATION			
Course Code Course Title	: Math 105 : Vector Analysis, Matrix and Coordinate Geometry	Contact Hours Credit Hours	: 3.00 : 3 .00
PRE-REQUISITE			
Course Code: Math 101 Course Title: Differential and Integral Calculus			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
RATIONALE			
To teach the students the basic concepts, principles and operations of vectors, matrices and application of geometry. The aim of this course is to develop the analytical capability of learner on vector, matrice and geometry. Finally, this course is designed to develop capability of students to solve practical problems related to vector, matrices and geometry.			
OBJECTIVE			
1. Be able to earn knowledge on the Vector Analysis, Matrix and Geometry. 2. Be able to work on principle of calculating differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical coordinate in geometry. 3. Be able to provide working capability using concept of vector, matrix and Geometry in engineering area and solve other applied problems. 4. Be expert in imparting the depth knowledge on the vector analysis, matrix and co-ordinate geometry.			

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Define** different terms of vector, matrix and geometry.	C1	1,3	–	1,3	T, F
CO2	**Explain** differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry.	C2			3	T, Mid Term Exam, F
CO3	**Explain** the nature of the vectors in a vector space.	C1, C3			3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Vector Analysis: Definition of vector, scalars, direction ratios, addition and subtraction of vectors, multiplication of vectors by scalars, position vector of a point, scalar and vector products of two vectors and their geometrical interpretation, triple products and multiple products, linear dependence and independence of vectors, differentiation of vectors, gradient of scalar functions, divergence and curl of point functions, physical significance of gradient, divergence and curl; line, surface and volume integral, Green's, Stoke's and Gauss's theorem and their application.

Matrix: Definition of matrix, different types of matrices, algebra of matrices, multiplication of matrices, transpose and adjoint of a matrix, inverse of a matrix, rank and elementary transformation, solution of system of linear equation, matrix polynomials, determination of characteristic roots and vectors, eigen-values and eigen-vectors, Caley-Hamilton theorem.

Coordinate Geometry: Introduction to geometry, rectangular co-ordinates, angle between two lines, transformation of co-ordinates, changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties; equation of conics, homogeneous equation of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves, equations of parabola, ellipse in Cartesian and polar coordinates, circles, system of circles (radical axes, coaxial circles, limiting points), three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane), standard equation of sphere, ellipsoid, hyperboloid.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Define** different terms of vector, matrix and geometry.	H											
CO2	**Explain** differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry.	H											
CO3	**Explain** the nature of the vectors in a vector space.	H											

Justification for CO-PO mapping:		
Mapping	Level	**Justifications**
CO1-POa	High	The knowledge of mathematics, science and engineering has to be applied to describe the operation of being able to identify the physical explanation of different vector notation, explain the complete concept about matrix, 2D and 3D geometry.
CO2-POa	High	Be able to **interpret** the way of calculation of volume and area of any object in vector field.
CO3-POa	High	In order to construct and calculate the area of objects related to engineering study by using vector, **solve** the system of linear equations using matrix and geometry related problems.

(H – High, M- Medium, L-low)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Definition of vector, Scalars and Vectors, Equality of direction ratios and vectors, Addition, Subtraction and multiplication of vectors Position vector of a point, Scalar and vector products of two vectors and their geometrical interpretation, Triple products and multiple products Linear dependence and independence of vectors, Differentiation of vectors	Class Test 1
2	Lec 4 Lec 5 Lec 6	Gradient of scalar functions, Divergence and curl of point functions, Physical significance of gradient, divergence and curl Physical significance of gradient, divergence and curl	
3	Lec 7 Lec 8	Integration of vectors (line, surface and volume integrals)	

	Lec 9		
4	Lec 10 Lec 11 Lec 12	Green's, Stoke's and Gauss's theorem and their application	Class Test 2
5	Lec 13 Lec 14 Lec 15	Definition of Matrix, different types of matrices, Algebra of Matrices, Multiplication of matrices Transpose and adjoint of a matrix, inverse of a matrix Rank and elementary transformation.	
6	Lec 16 Lec 17 Lec 18	System of Linear Equations Linear dependence and independence of vectors Matrix polynomials, determination characteristic roots and vectors	
7	Lec 19 Lec 20 Lec 21	Null space and nullity of matrix, characteristic subspace of matrix Eigen values and eigen vectors Caley-Hamilton theorem - concepts and problems	
8	Lec 22 Lec 23 Lec 24	Introduction to geometry, Rectangular co-ordinates, Angle between two lines Transformation of co-ordinates, changes of axes, The plane-angle between two planes, pair of straight lines	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Pair of straight lines, general equation of second degree and reduction to its standard forms and properties Circles (tangents, normal, chord of contact, pole and polar)	
10	Lec 31 Lec 32 Lec 33	Equation of conics Homogeneous equations of second degree	
11	Lec 28 Lec 29 Lec 30	Angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves, equations of parabola, ellipse in Cartesian and polar coordinates, Pair of lines joining the origin to the point of intersection of two given curves, equations of parabola, ellipse in Cartesian and polar coordinates	Class Test 3
12	Lec 34 Lec 35 Lec 36	System of circles (radical axes, coaxial circles, limiting points), Three-dimensional co-ordinate system,	
13	Lec 37 Lec 38 Lec 39	Direction cosines, projections, The plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane).	
14	Lec 40 Lec 41 Lec 42	The straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2, C3
			CO 2	C3, A6
			CO3	C2, C3
	Class Attendance	5%	-	-

	Class Observation	5%	CO3	C2, C3
	Mid Term	10%	CO 2, CO3	C2, C3
Final Exam		60%	CO 1	C1, C2
			CO 2	C1, C2, C3
			CO 3	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT BOOKS

1. Vector Analysis - Schaum's outlines by Seymour Lipschutz, Dennis Spellman and Murray R. Spiegel
2. College Linear Algebra- Md. Abdur Rahman
3. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee

REFERENCE BOOKS

1. Elementary Linear algebra - Wiely, Howard Anton and Chris Rorres
2. Linear Algebra-Schaum's Outline Series
3. Analytic Geometry -Abdur Rahman.

REFERENCE SITES

ME-122: Fundamentals of Mechanical Engineering Sessional

COURSE INFORMATION

Course Code Course Title	: ME-122 : Fundamentals of Mechanical Egineering Sessional	Lecture Contact Hours Credit Hours	: 4.00 : 2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to introduce the students with various fields of Mechanical Engineering with a special consideration to the fields relevant to the computer science and engineering discipline. A good number of theory based and lab-based sessions are included to enhance the confidence of the students in this branch of engineering.

OBJECTIVE

1. To make the students familiar to with engine and its various features.
2. To make the students familiar with various types of power plant.
3. To make the students familiar with various heat transferring devices.
4. To make the students familiar with power and motions transferring element used in robot design.
5. To make the students familiar with various types of robots and their control.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

CO1	Understand theoretical and practical knowledge of vehicle components and control.	C2	1,2	1,2	1,2	ASG, Q, R
CO2	Explain introductory theoretical and practical knowledge of power plant and their main components.	C4			1	ASG, Q, R
CO3	Demonstrate fundamental ideas about heat transferring devices	P2			2	ASG, Q, R
CO4	Demonstrate basic knowledge about power transferring elements and components of robot.	P3			2	ASG, Q, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

IC Engine, Automobile, Hybrid and Electric Vehicle: Types of IC Engine, Operating principle, thermodynamic cycle, Valve timing diagram, VVTi, ECM, Sensors used in modern vehicle, Hybrid Technology, Electric vehicle; **Power plant:** Types of power plant, Introduction to Coal based, Gas based and Nuclear power plant, Control system of power plant, Steam generator, Cooling tower; **Heat Transfer and equipment:** Modes of heat transfer, Heat transfer using finned surface, Thermo-electric cooling, Heat pipe, Cooling of microchip and processor; **Pump, Compressor, Valve:** Centrifugal pump, Positive displacement pump, Hydraulic and pneumatic actuator, Control valve (Pressure, flow and direction control valve); **Kinematics of Rigid body:** Truss, Frame, Kinematic linkage; **Power transferring devices:** Belt-pulley, Various types of gear and gear train, Fluid Coupling, CVT; **Robotics and Control:** Introduction to Robotics, Plane, rotational and spatial motion with applications to manipulators, Geometric configurations, arms and grippers, Control system of robots;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand theoretical and practical knowledge of vehicle components and control.		H										
CO2	Explain introductory theoretical and practical knowledge of power plant and their main components.	H											
CO3	Demonstrate fundamental ideas about heat transferring devices			L									
CO4	Demonstrate basic knowledge about power transferring elements and components of robot.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	Students will have both theoratical and practical knowledge regarding engine snd vehicle components and operation that will impct both knowledge from basic science and engineering practice.

CO2-POa	High	Students will have theoretical knowledge as well as established engineering practices on power plant components and their operation.
CO3-POc	Low	Students will have and use knowledge on cooling tower that guide the design of cooling tower in real field.
CO4-POb	High	Students will learn technique to peform analysis of simple robot structure.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	56
Practical / Tutorial / Studio	25
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	
Final Examination	5.5
Total	96.5

TEACHING METHODOLOGY

Class Lecture, Lab Experiments, Report, Problem Solving

COURSE SCHEDULE

Week	**Lecture**	**Topics**
1-2	Lec 1- Lec 8	IC Engine, Automobile, Hybrid and Electric Vehicle — Types of IC Engine, Operating principle, thermodynamic cycle, Valve timing diagram, VVTi, ECM, Sensors used in modern vehicle, Hybrid Technology, Electric vehicle.
3-4	Lec 9-Lec 14	Power plant — Types of power plant, Introduction to Coal based, Gas based and Nuclear power plant, Control system of power plant, Steam generator, Cooling tower.
5-6	Lec 15-Lec 18	Heat Transfer and equipment— Modes of heat transfer, Heat transfer using finned surface, Thermo-electric cooling, Heat pipe, Cooling of microchip and processor.
7-8	Lec 19-Lec 24	Pump, Compressor, Valve – Centrifugal pump, Positive displacement pump, Hydraulic and pneumatic actuator, Control valve (Pressure, flow and direction control valve)
9-10	Lec 25-Lec 34	Kinematics of Rigid body – Truss, Frame, Kinematic linkage,
11-12	Lec 35-Lec 44	Power transferring device – Belt-pulley, Various types of gear and gear train, Fluid Coupling, CVT
13-14	Lec 45-Lec 56	Robotics – Introduction to Robotics, Plane, rotational and spatial motion with applications to manipulators, Geometric configurations, arms and grippers, Control system of robots.

ASSESSMENT STRATEGY

<table>
<tr><td colspan="3"></td><td rowspan="2">CO</td><td rowspan="2">Blooms Taxonomy</td></tr>
<tr><td colspan="2">Components</td><td>Grading</td></tr>
<tr><td>Continuous Assessment (40%)</td><td>Assignment</td><td>40%</td><td>CO1-CO4</td><td>C2, C4, P2, P3</td></tr>
<tr><td rowspan="2">Final Exam</td><td>Report</td><td rowspan="2">60%</td><td rowspan="2">CO1-CO4</td><td rowspan="2">C2, C4, P2, P3</td></tr>
<tr><td>Quiz</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. A Text Book of Thermal Engineering - R S Khurmi& J K Gupta
2. Heat Engines – D. A. Low
3. Thermal Engineering- Mahesh M Rathor

REFERENCE SITE

LEVEL-2 SPRING TERM

CSE-203: Data Structures & Algorithms I

COURSE INFORMATION			
Course Code Course Title	: CSE-203 : Data Structures & Algorithms I	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: CSE 105 Course Title: Structured Programming Language

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
This Data Structures & Algorithms I course is designed to provide a clear concept on the essential parts of the data structures and algorithms related to computer science. This course begins with the introduction of basic concepts of some commonly used data structures and algorithms and then covers time complexity, linked list, stack, queue, graph, sorting and various relevant important topics.

OBJECTIVE
1. To develop a general understanding of basic data structures and algorithms 2. To develop Programming skills for data structures and algorithms

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom 's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Express the fundamentals of static and dynamic data structures and relevant standard algorithms.	C1-C3	1,3	-	1	T
CO2	Demonstrate advantages and disadvantages of specific algorithms and data structures.	C4			1	T, MT
CO3	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.	C2-C4			1,5	F
CO4	Determine and demonstrate bugs in the program, recognize needed basic operations with algorithms and data structures.	C2-C4			1	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Class Test; MT-Midterm, PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT
-Introduction: Introduction to data structures and algorithms, array representation in memory, array mapping function, asymptotic notation; **Array searching:** Linear search, Binary search; **Sorting:** Bubble sort, Insertion sort, Count sort; **Linked list:** Single linked list, double linked list; **FIFO-LIFO:** Stack, Queue; **Graph Theory:** Introduction, classification of graph, representation of graph, breadth first search, depth first search; **Trees:** Classification of trees, tree traversal, Binary search tree, Segment tree; **List and Hashing:** Skip list, Hash table, Hashing; **String matching algorithm:** Knuth–Morris–Pratt(KMP) algorithm.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Express the fundamentals of static and dynamic data structures and relevant standard algorithms.	H											
CO2	Demonstrate advantages and disadvantages of specific algorithms and data structures.	H											
CO3	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.		M										
CO4	Determine and demonstrate bugs in the program, recognize needed basic operations with algorithms and data structures.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth and depth of knowledge by expressing the fundamentals of static and dynamic data structures and relevant standard algorithm
CO2-POa	High	Increase breadth and depth of knowledge by demonstrating advantages and disadvantages of specific algorithms and data structures
CO3-POb	Medium	Analyze and formulate different methods of analysis to select basic data structures and algorithms for autonomous realization of simple programs or program parts
CO4-POb	High	Analyze and formulate different methods of analysis to determine and demonstrate bugs in the program, recognize needed basic operations with algorithms and data structures

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to data structure Representation of array in memory Array mapping function Asymptotic notation	Class Test 1
2	Lec 4 Lec 5 Lec 6	Searching in array: Linear search, Binary search	
3	Lec 7 Lec 8 Lec 9	Sorting: Bubble sort, Insertion sort, Count sort Single Linked List	
4	Lec 10 Lec 11 Lec 12	Doubly Linked List	Class Test 2
5	Lec 13 Lec 14 Lec 15	Stack Queue	
6	Lec 16 Lec 17 Lec 18	Introduction to Graph Theory Notations of Graph Classification of Graph	
7	Lec 19 Lec 20 Lec 21	Introduction to Graph Theory Notations of Graph Theory Representations of Graph Classification of Graph	
8	Lec 22 Lec 23 Lec 24	Breadth first search Depth first search	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Introduction to Trees Classification of Trees Tree traversal techniques: Preorder, Inorder, Postorder	
10	Lec 28 Lec 29 Lec 30	Binary Search Tree	
11	Lec 31 Lec 32 Lec 33	Segment Tree	Class Test 3
12	Lec 34 Lec 35 Lec 36	Skip list	
13	Lec 37 Lec 38 Lec 39	Hash table, Hashing	
14	Lec 40 Lec 41 Lec 42	Knuth–Morris–Pratt string matching algorithm	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C2, C3
	Class Performance	5%	CO4	C6

	Mid term	10%	CO2	C2-C4
	Class Attendance	5%	-	-
Final Exam		60%	CO3	C2-C4
			CO4	C2-C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to Algorithms (CLRS) 3rd Edition Sep 2009 - Cormen, Thomas H, Leiserson, Charles E, Rivest, Ronald L, Stein, Clifford
2. Data Structures and Algorithm Analysis in C++ 2014 - Mark Allen Weiss

CSE-204: Data Structures & Algorithms I Sessional

COURSE INFORMATION

Course Code	:	CSE-204	Lecture Contact Hours	: 3.00
Course Title	:	Data Structures & Algorithms I Sessional	Credit Hours	: 1.50

PRE-REQUISITE

Course Code: CSE 106
Course Title: Structured Programming Language Sessional

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This Data Structures & Algorithms I sessional course is designed to provide a clear concept on the implementation of the essential parts of the data structures and algorithms related to computer science. This course begins with the implementation of some commonly used data structures including linked list, stack, queue and then covers various relevant important topics related to this course.

OBJECTIVE

1. To develop a general understanding of basic data structures and algorithms
2. To develop programming skills for advanced data Structures and algorithms

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be familiar with different types of algorithms and data structures and their pros and cons in different prospects	P2	1,3	2	3	Evaluation, Online, Quiz
CO2	Select basic data structures and algorithms for the autonomous realization of simple programs or program parts.	P3			3	
CO3	Formulate new solutions for problems or improve existing code using learned algorithms and data structures.	P4, P6			5	

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Array operations: Operations on static array list, operations on dynamic array list; **Array Searching:** Binary search; **Linked List:** Single linked list, Doubly linked list; **FIFO-LIFO:** Stack, Queue; **Graph Theory:** Graph representation, Breadth first search, Depth first search; **Tree:** Tree traversals, Binary search tree, segment tree; **String matching algorithm:** KMP algorithm

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Be familiar with different types of algorithms and data structures and their pros and cons in different prospects	M											
CO2	Select basic data structures and algorithms for autonomous realization of simple programs or program parts		M										
CO3	Formulate new solutions for problems or improve existing code using learned algorithms and data structures			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	Medium	Develop a knowledge on different data structures and algorithms
CO2-POb	Medium	Increase breadth and depth of knowledge by selecting basic data structures and algorithms for autonomous realization of simple programs or program parts.
CO3-POc	High	Analyze and formulate different methods of analysis to formulate new solutions for problems or improve existing code using learned algorithms and data structure

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	36
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	4
Final Examination	6
Total	**46**

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**

1	Lab 1	Operations on static array list	
2	Lab 2	Operations on dynamic array list	
3	Lab 3	Single linked list, Double linked list	
4	Lab 4	Stack implementation by array and linked list	
5	Lab 5	Queue Circular Queue	
6	Lab 6	Binary Search, Different types of Sorting (Insertion, Selection, Bubble)	
7	Lab 7	Online 1	
8	Lab 8	Binary Search Tree (Insertion, Deletion, Search)	
9	Lab 9	Breadth first search	
10	Lab 10	Depth first search	
11	Lab 11	Minimum Spanning Tree (Prim’s and Kruskal)	
12	Lab 12	Segment Tree	
13	Lab 13	Skip List and KMP (Knuth–Morris–Pratt) algorithm	
14	Lab 14	Online 2 and Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Evaluation	30%	CO1	P2
Final Online Exam 1 and 2	50%	CO2, CO3	P3, P4, P6
Quiz	20%	CO1, CO2	P2, P3
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
2. Data Structures Using C by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe Augenstein. International edition

REFERENCE SITE

https://www.shafaetsplanet.com/
https://www.geeksforgeeks.org/data-structures/?ref=shm_outind
https://www.tutorialspoint.com/data_structures_algorithms/index.htm

CSE-205: Object Oriented Programming Language

COURSE INFORMATION			
Course Code Course Title	: CSE-205 : Object Oriented Programming Language	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: CSE 105
Course Title: Structured Programming Language

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Object-oriented programming course is designed to provide a comprehensive understanding to 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. To Present object-oriented aspects of C++
3. To learn programming with C++

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Grasp, understand and utilize the fundamental features of an object-oriented programming language.	C1-C4	1,3	1	1	T, MT
CO2	Deduce object-oriented solutions for small problems, involving multiple objects.	C3, C5, C6			5	T, F
CO3	Illustrate good programming style and identify the impact of style on developing and maintaining programs.	C3-C4, C6			8	F
CO4	Develop the communication skill by presenting topics on Object Oriented Programming.	A2				PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Midterm Exam)

COURSE CONTENT

OOP Introduction: Philosophy of Object Oriented Programming (OOP), Advantages of OOP over structured programming; Features: Encapsulation, Inheritance, Polymorphism; Introduction to class and objects : classes and objects, access specifiers, static and non-static members; Constructors and Destructors: Constructors, Destructors, Copy Constructors; Pointers of objects: Array of objects, object pointers, and object references; Functions: Member Functions, In-line functions, friend functions, static functions; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Error Handling: Exception Handling; Object Oriented I/O: Object Oriented I/O ; Templates: Template functions and classes; Namespace and template libraries: Concept of Namespaces, Overview of Standard Template Library (Vectors & Iterators); Threads: Multi-threaded Programming, Abstract Data Types. Basic Concept on java, basic operation and command line. Class abstraction, Interface, Closure. Generic Class and Methods, Java I/O (serialization) and stream, Collection Frameworks, Concurrency.

SKILL MAPPING													
No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Grasp, understand and utilize the fundamental features of an object-oriented programming language		H										
CO2	Deduce object-oriented solutions for small problems, involving multiple objects.			H									
CO3	Illustrate good programming style and identify the impact of style on developing and maintaining programs				H								
CO4	Develop the communication skill by presenting topics on Object Oriented Programming.										L		

(H–High, M–Medium, L–Low)

JUSTIFICATION FOR CO-PO MAPPING:		
Mapping	Level	Justifications
CO1 – POb	High	To analyze the complex engineering problems, one needs to understand the benefit and analyze when object-oriented programming is an appropriate methodology to use.
CO2 – POc	High	To design and develop solutions for complex engineering problems, one needs to be able to deduce object-oriented solutions for small problems, involving multiple objects.
CO3-POd	High	To investigate complex problems, one need to have skill on good programming style and identify the impact of style on developing and maintaining programs.
CO4–POj	Low	In order to give presentation on the selective topics from the course taught we need strong communication skills

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Overview of Object-Oriented Programming (OOP) and introduction to C++; Features of OOP, namespaces	

2	Lec 4 Lec 5 Lec 6	Introduction to class and objects, Access Specifiers	Class Test 1
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 Constructor	
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	Mid Term Exam
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, binary operators, multiple overloading, Comparison operators	
11	Lec 28 Lec 29 Lec 30	Basic Concept on java, basic operation and command line	Class Test 3
12	Lec 34 Lec 35 Lec 36	Class abstraction, Interface, Closure	
13	Lec 37 Lec 38 Lec 39	Generic Class and Methods, Exception Handling	
14	Lec 40 Lec 41 Lec 42	Java I/O (serialization) and stream, Collection Frameworks, Concurrency	

ASSESSMENT STRATEGY

Components		Grading	COs	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C4
			CO2	C3, C5, C6
	Class Participation	5%	CO4	A2
	Mid term	10%	CO1	C1-C4
	Class Attendance	5%	-	-
Final Exam		60%	CO2	C3, C5,C6
			CO3	C3-C4, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)
REFERENCE BOOKS
1. C++: The Complete Reference" by Herbert Schildt:4th edition, McGraw-Hill Education 2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 3rd Edition, MIT Press 3. Data Structures and Algorithm Analysis in C++ by Mark A. Weiss.3rd edition, Pearson Publisher

CSE-206: Object Oriented Programming Language Sessional

COURSE INFORMATION

Course Code	:	CSE-206	Lecture Contact Hours	: 3.00
Course Title	:	Object Oriented Programming Language Sessional	Credit Hours	: 1.50

PRE-REQUISITE

Course Code: CSE 106
Course Title: Structured Programming Language Sessional

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Object-oriented programming course is designed to provide a comprehensive understanding of 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

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

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Design object-oriented solutions for small systems/ problems, involving multiple objects.	C6	1,3	3	5	E, O
CO2	Identify the relative merits of different algorithmic designs, programming constructs and data structures.	P5			7	Q, V
CO3	Write code, test, document and prepare a professional looking package for specified systems / problems.	C1, C6			5	E, ASG, O

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Introduction to OOP: Advantages of OOP over structured programming; Introduction to classes and objects: Encapsulation, classes and objects, access specifiers, static and non-static members; Introduction to Constructors and Destructor: Constructors, Destructors and Copy Constructors; Array of objects: Array of objects, object pointers, and object references; Function: Member Functions, In-line functions, friend functions, static functions; Inheritance: single and multiple inheritance; Polymorphism: overloading, abstract classes, virtual functions and overriding; Exception Handling:

Exception Handling; OOP I/O: Object Oriented I/O ; Templates: Template functions and classes; Namespace: Concept of Namespaces, Overview of Standard Template Library (Vectors & Iterators); Thread: Multi-threaded Programming, Abstract Data Types.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Design object-oriented solutions for small systems/ problems, involving multiple objects.			H									
CO2	Identify the relative merits of different algorithmic designs, programming constructs and data structures.						H						
CO3	Illustrate good programming style and identify the impact of style on developing and maintaining programs.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POc	High	Design object-oriented solutions for small systems/ problems, involving multiple objects
CO2-POf	High	In order to apply reasoning and take responsibilities relevant to the professional engineering practice, one needs to identify the relative merits of different algorithmic designs, programming constructs and data structures.
CO3-POi	High	In order to function effectively as an individual or leader of a team, one need to be able to write code, test, document and prepare a professional looking package for specified systems / problems

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	4
Final Examination	3
Total	49

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lab 1	Introductory session on OOP	

2	Lab 2	Structure and Classes with namespace
3	Lab 3	Class and objects with access specifier
4	Lab 4	Member Functions, In-line functions, Friend functions
5	Lab 5	Introduction to the concept of Constructors and Destructors
6	Lab 6	Copy Constructors
7	Lab 7	Inheritance: Introduction, derived and base classes, accessing base class members, access specified for protected
8	Lab 8	Multiple inheritance, Constructor and destructor in Inheritance
9	Lab 9	Virtual functions, runtime polymorphism
10	Lab 10	Overriding Abstract class
11	Lab 11	Operator overloading: Introduction, overloading of unary operators
12	Lab 12	Operator overloading: Overloading of binary operators
13	Lab 13	Multiple overloading
14	Lab 14	Copy Constructors

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Evaluation	20%	CO1	C6
			CO3	C3. C6
	Class Participation	5%	CO2	P5
	Assignment	10%	CO3	C3, C6
Online Test 1		25%	CO1	C6
			CO3	C3, C6
Online Test 2		25%	CO3	C3, C6
Quiz		15%	CO2	P5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

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

REFERENCE SITE

CSE-217: Theory of Computation

COURSE INFORMATION			
Course Code Course Title	: CSE-217 : Theory of Computation	Lecture Contact hours Credit hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The course is designed 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. To understand the mathematical foundations of computation including automata theory. 2. To have a solid foundation of the theory of formal languages and grammar. 3. To analyze and design finite automata, pushdown automata, Turing machines, formal languages and languages, and grammars.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify the mathematical foundations of computation including mathematical proofs for computation.	C3, C5	1,3		2,3	MT, F
CO2	Design finite automata and regular expressions for regular languages.	C4, C6			4, 5	MT, F
CO3	Design context-free grammar and pushdown automata for context-free languages.	C4, C6			3,4 5	MT, F
CO4	Illustrate Turing machines and investigate the limits of algorithmic solvability.	C2, C4			3,4,5	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Midterm Exam)

COURSE CONTENT

Regular language: deterministic finite automata, nondeterministic finite automata, equivalence and conversion of deterministic and nondeterministic finite automata, regular expressions, non-regular languages, the pumping lemma; **Context-free language:** Context free grammars, Chomsky normal form, Greibach Normal Form, Pushdown automata; **Turing Machines:** basic machines, configuration, computing with Turing machines, combining Turing machines; **Decidability:** decidable languages, undecidability.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify the mathematical foundations of computation including mathematical proofs for computation.		H										
CO2	Design finite automata and regular expressions for regular languages.			H									

CO3	Design context-free grammar and pushdown automata for context-free languages.			H									
CO4	**Design** Turing machines and investigate the limits of algorithmic solvability.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	It requires identifying different mathematical proofs for different computation models.
CO2-POc	High	It requires designing finite automaton and regular expression for different regular language which is complex in nature meeting specific needs of the language.
CO3-POc	High	It requires to design context free grammar and pushdown automaton for different context free language which is complex in nature meeting specific needs of the language.
CO4-POc	High	It requires to design Turing machines for wide ranges of language and find out solvability of any algorithm for illustrating it using Turing Machines.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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.	Class Test 1
2	Lec 4 Lec 5 Lec 6	Finite Automata Formal Definition of a Finite Automaton Examples of Finite Automata	
3	Lec 7 Lec 8 Lec 9	Formal Definition of Computation Designing Deterministic Finite Automata	
4	Lec 10 Lec 11 Lec 12	The Regular Operations Union operation, Concatenation operation, Star operation, Closure under the Regular Operations	Class Test 2
5	Lec 13 Lec 14 Lec 15	Nondeterminism Equivalence of NFAs and DFAs Closure under the Regular Operations	
6	Lec 16	Regular expressions	

	Lec 17 Lec 18	Formal definition of a regular expression	
7	Lec 19 Lec 20 Lec 21	Nonregular Languages, The Pumping Lemma for Regular Languages.	
8	Lec 22 Lec 23 Lec 24	Context-Free Languages Context-Free Grammars Formal Definition of CFG	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Examples of CFG, Designing CFG Ambiguity	
10	Lec 31 Lec 32 Lec 33	Chomsky Normal Form I Chomsky Normal Form II	
11	Lec 28 Lec 29 Lec 30	Pushdown Automata Formal Definition of a Pushdown Automaton Examples of Pushdown Automata.	Class Test 3
12	Lec 34 Lec 35 Lec 36	Non-context-free languages The pumping lemma for context-free languages and proofs	
13	Lec 37 Lec 38 Lec 39	Turning Machines, Formal Definition of a Turing Machine, Examples of Turing Machines.	
14	Lec 40 Lec 41 Lec 42	Decidability, decidable languages, Decidable problems concerning Regular languages	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	-	-
			-	-
			-	-
	Class Participation	5%	-	-
	Mid term	10%	CO2	C4, C6
			CO3	C4, C6
	Class Attendance	5%	-	-
Final Exam		60%	CO1	C3, C5
			CO2	C4, C6
			CO3	C4, C6
			CO4	C2, C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to the Theory of Computation, 3rd edition, 2012- Michael Sipser.
2. Introduction to Automata Theory, Languages, and Computation. Addison-Wesley Longman Publishing Co., Inc., 3rd ed., 2008 - J. E. Hopcroft, R. Motwani, and J. D. Ullman.
3. Elements of the Theory of Computation. Upper Saddle River, NJ, USA: Prentice Hall PTR, 2nd edition, 1997- H. R. Lewis and C. H. Papadimitriou.

REFERENCE SITE

EECE-269: Electrical Drivers and Instrumentation

COURSE INFORMATION			
Course Code Course Title	: EECE-269 : Electrical Drivers and Instrumentation	Lecture Contact Hours Credit Hours	: 3.00 : 3.00
PRE-REQUISITE			
Course Code: EECE 163 Course Title: Electrical Circuit Analysis			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
RATIONALE			
This course is designed to familiarize students with electrical energy conversion devices such as generator, motor, transformer and deliver fundamental knowledge on electrical measurement and instrumentation system. The course is designed with the basic contents of electrical machines construction, operating principles, characteristics and applications.Students will also be able to learn different electrical measurement and instrumentation techniques, data conditioning and telemetry devices working principles for engineering applications.			
OBJECTIVE			
1. To appraise the operating principle and constructional details of energy conversion devices such as transformer, motor, generator. 2. To develop understanding on practical use of energy conversion devices. 3. To impart the knowledge of the basics of electrical measurement system components along with different methods of measurement. 4. To develop the ability to analyse typical measurement data obtained and determine performance metrics.			

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Describe** the principle of operations, explain the construction, classify as per construction or operation of different electrical machines like generators, motors and transformers.	C2	1	1	2, 3	T, F
CO2	**Comprehend** the basics of electrical measurement and instrumentation systems, their characteristics and different methods.	C3			2, 3	F, ASG
CO3	**Analyze** measurement data and information through the study, design and performance evaluation of measurement systems.	C4			2, 3	MT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Three phase circuits, alternators and transformers, principles & operation of DC Machines, synchronous, induction, universal and 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 to microprocessor-based systems;
Transducers: Terminology, types of transducers, principles and applications of photovoltaic, piezoelectric, thermoelectric, variable resistance and opto-electronics transducers. Noise reduction in instrumentation;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Describe** the principle of operations, explain the construction, classify as per construction or operation of different electrical machines like generators, motors and transformers.	H											
CO2	**Comprehend** the basics of electrical measurement and instrumentation systems, their characteristics and different methods.	H											
CO3	**Analyze** measurement data and information through the study, design and performance evaluation of measurement systems.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Breadth and depth of knowledge will be achieved partially through describing operating mechanism of energy conversion devices.
CO2-POa	High	Breadth and depth of knowledge will be achieved through comprehending the electrical measurement systems, their characteristics and different methods.
CO3-POc	High	Breadth and depth of knowledge will be achieved through the study, design and performance evaluation of measurement systems.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method.

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	**DC Generator**	
		Overview of Electrical Energy conversion	
		Introduction to DC generator and its principle of operation	
		Commutation principle and slip rings	
2	Lec 4 Lec 5	**DC Generator**	
		Construction of DC generator and different parts	

	Lec 6	Lap winding and wave winding and its comparison	Class Test 1
		Emf equation of DC generator and related mathematical problems	
3	Lec 7 Lec 8 Lec 9	**DC Motor**	
		Construction and operating principle of DC motor	
		Flemings right hand rule and left-hand rule, conversion of energy	
		Differences between DC generator and DC motor	
4	Lec 10 Lec 11 Lec 12	**DC Motor**	Class Test 2
		Back emf and related equations for DC motor	
		Speed control, Torque –speed characteristics of different types DC motors.	
		Related mathematical problems of DC motor	
5	Lec 13 Lec 14 Lec 15	**Transformer**	
		Introduction to Transformer and its principle of operations	
		Types of transformer and ideal characteristics	
		Equivalent circuit of Transformer	
6	Lec 16 Lec 17 Lec 18	**Transformer**	
		Vector diagrams of transformer under different conditions	
		Mathematical problems of Transformer	
		Losses in transformer and their explanations	
7	Lec 19 Lec 20 Lec 21	**Synchronous Generator**	Mid Term Exam
		Synchronous Generator: Operating principle	
		Excitation systems of Synchronous Generator	
		equivalent circuit of synchronous Generator	
8	Lec 22 Lec 23 Lec 24	**Instruments & Measurement overview**	
		Introduction on Measurement and instrumentation	
		Basic requirements, significance and methods of measurement.	
		Functional elements of a generalized measurement system and classification of instruments.	
9	Lec 25 Lec 26 Lec 27	**Transducers**	
		Transducers: Introduction, advantage of using Electrical Transducers	
		. Resistance, Inductance and Capacitive transducer	
		Hall effect transducer and Optical transducer.	
10	Lec 28 Lec 29 Lec 30	**Transducers**	
		Thermocouple, Resistance Temperature Detector and Thermistor.	
		Thermal Imaging- Applications, Measurement of Strain	
		Measurement of Force (piezoelectric sensors) and Torque.	
11	Lec 31 Lec 32 Lec 33	**Noise Performance Analysis**	
		Noise in a measurement system: Typical source of noise in a measurement system.	
		Types of noise in measurement system- Electromagnetic Interference, Inductive and Capacitive coupling.	
		Techniques for compensation of noise: Shielding, Filtering and Ground isolation.	
12	Lec 34 Lec 35 Lec 36	**Signal Conditioning**	
		Overview of signal conditioning: Noise elimination and compensation, Amplification, Linearization.	
		Different methods in use: A\D and D\A conversion for suitable output devices and data acquisition.	
		A\D converters: Basics, techniques- parallel/flash,	

		single slope (ramp), successive approximation, sample and hold circuit	
13	Lec 37 Lec 38 Lec 39	**Instrumentation Amplifiers**	Class Test 3
		Different instrumentation amplifier, Operation amplifiers	
		Application of amplifiers, filters for signal conditioning	
		Data Acquisition system: Microprocessor and embedded system applications.	
14	Lec 40 Lec 41 Lec 42	**Data Transmission, Telemetry and Data Presentation**	
		Current, Voltage and Frequency telemetry. Telemetry Applications	
		Various types of display devices and their interfacing and applications	
		Practical measurement system analysis and Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test & Assignment 1-3	20%	CO 1	C3
			CO 2	C6
	Class Performance	5%	CO 2	C6
	Mid term	10%	CO3	C3
	Class Attendance	5%	-	-
Final Exam		60%	CO 1	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Electrical Machinery Fundamentals- Stephen J Chapman
2. A Textbook of Electrical Technology - B.L Theraja
3. A Course in Electrical and Electronic Measurements and Instrumentation by A. K. Sawhney
4. Electronic Instruments and Instrumentation Technology', by M. M. S. Anand

EECE-270: Electrical Drives and Instrumentation Sessional

COURSE INFORMATION

Course Code Course Title	: EECE-270 : Electrical Drives and Instrumentation Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternbative wk : 0.75

PRE-REQUISITE

Course Code: EECE 269
Course Title: Electrical Drives and Instrumentation.

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to help the students to explore various DC and AC machines and put theory in practice. Our mission is to expose students to the constructions of electrical machines and analyse their performance. This course is targeted to verify the properties of generator, motor etc. and relate them with their theoretical knowledge. Our aim is to give the students the basic idea of how these machines fit in large context. This course is also designed to give the students the basic idea of electronic instrumentation system.

OBJECTIVE

1. To familiarize the students with the basic electrical machines like transformer, dc generator, dc motor, alternator etc.
2. To calculate various parameters of machines like voltage regulation, efficiency etc., observe their behavior under various load conditions and compare them.
3. To impart the basic knowledge of electrical control system and instrumentation.
4. To impart practical knowledge on electrical machine crafting and develop collaborative learning skill.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcomes (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Compute** the voltage regulation and efficiency of electrical machine, like transformer, alternator, dc motor etc. and justify these characteristics under various loading condition	C4, P4	1	1,3,5	2	R, Q, LT
CO2	Experimentally **comprehend** the characteristics of electrical machines like dc generator, dc motor, alternator, etc. using the prototype modules.	P4			1,3,6	R, Q, LT
CO3	**Construct** controlled systems relating the concept of feedback control method and controller design techniques.	P4			3,6	R, Q, LT
CO4	**Perform** project task and **design** electrical machine adapting to requirement.	P6			5	LT, PR, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

In this course, students will perform experiments to practically verify the theories and concepts learned in EECE 269 using different hardware equipment and simulation software.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	**Compute** the voltage regulation and efficiency of electrical machine, like transformer, alternator, dc motor etc. and justify these characteristics under various loading condition				H								
CO2	Experimentally **comprehend** the characteristics of electrical machines like dc generator, dc motor, alternator, etc. using the prototype modules.					H							
CO3	**Construct** controlled systems relating the concept of feedback control method and controller design techniques.					H							
CO4	**Perform** project task and **design** electrical machine adapting to requirement.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POd	High	Students will function effectively to investigate the electrical machine's performance.
CO2-POe	High	Level of understanding of the appropriateness of the tools will be achieved through working with the devices.
CO3-POe	High	Develop controlled systems by applying feedback control methodologies and techniques in controller design through modern tools.
CO4-POi	High	While designing electrical machine, they will learn about individual role and team management.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Practical	14
Self-Directed Learning	
Preparation of Lab Reports	3
Preparation of Lab Test	3
Preparation of presentation	2
Preparation of Quiz	3
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	7
Final Examination	1
Total	50

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method.

COURSE SCHEDULE

Week	Lecture	Topics
1, 2	Lec 1	Expt-01: Computing the regulation of the Transformer in Various Loads.
3, 4	Lec 2	Expt-02: Study the properties of DC self and separately excited shunt generator.
5, 6	Lec 3	Expt-03: Identifying the characteristics of DC shunt motor & calculating the efficiency.
7, 8	Lec 4	Expt-04: Study the properties of Three-Phase Alternator in various loads.
9, 10	Lec 5	Expt-05: Flow rate control of water by feedback transducer
11, 12	Lec 6	Expt-06: Water level control by feedback transducer.
13, 14	Lec 7	Lab Test, Quiz, Project Presentation and viva

ASSESMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Participation and Report	20%	CO1	P3
			CO2	P4
			CO 3	P4
	Labtest	30%	CO1	P3
			CO2	P4
			CO 3	P4
	Project and Presentation	25%	CO4	P6
Lab Quiz		25%	CO 1	P3
			CO 2	P4
			CO 3	P4

Total Marks	100%	

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS
1. Electrical Machinery Fundamentals- Stephen J Chapman. 2. Electrical machinery and Transformer – Irving L. Kosow. 3. Electrical machines- Samarjit Ghosh. 4. A Textbook of Electrical Technology - B.L Theraja. 5. Direct and Alternating Current Machinery – Jack Rosenblatt & Friedman
REFERENCE SITE

LANG-202: Communicative English - II

COURSE INFORMATION			
Course Code Course Title	: LANG-202 : Communicative English - II	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The English language course is designed for the students to develop their competence in communication skills for academic purposes especially in reading and writing. The approach will be communicative and interactive and will involve individual, pair and group work. In addition, the course emphasizes on providing constructive feedback on students' oral performances.
OBJECTIVE
1. To develop English language skills to communicate effectively and professionally. 2. To strengthen students' presentation skills. 3. To develop competency in academic reading and writing.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the techniques of academic reading and become acquainted with technical vocabularies	C2	1	2,4,5	1	ASG, Q
CO2	Understand the techniques of effective academic writing such as research article/report writing	C2			1	Q
CO3	Communicate effectively within the shortest possible time to present any report and research work	C4			1	Pr, R
CO4	Analyze any problem critically, analyze and interpret data and synthesize information to provide valid conclusions	C3			1	ASG/Pr, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Midterm Exam)

COURSE CONTENT

Reading: Reading Comprehension - Practice using different techniques, Academic reading - comprehension from departmental or subject related passages, Vocabulary for Engineers (some common Engineering terms for both general and dept specific), reading subject specific text to develop vocabulary; **Writing:** Writing semi-formal, Formal/official letters, Official E-mail, Applying for a job - Writing Cover Letter and Curriculum Vitae, Statement of Purpose (SOP) writing, Proposal Writing: writing steps, principles and techniques, outlining, revising, editing, proofreading; Report writing, article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing; Analyzing and describing graphs or charts Practicing analytical and argumentative writing;

Speaking: Public Speaking: Basic elements and qualities of a good public speaker, Set Speech: How to get ready for any speech, Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing powerpoint slides, etc. Selected books/Selected stories for presentation;

Listening: Listening to long lecture on some topics, Listening and understanding speeches/lectures of different accent;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the techniques of academic reading and become acquainted with technical vocabularies	H											
CO2	Understand the techniques of effective academic writing such as research article/report writing	H											L
CO3	Communicate effectively within the shortest possible time to present any report and research work									M	H		
CO4	Analyze any problem critically, analyze and interpret data and synthesize information to provide valid conclusions		M		M						H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Obtain the basic knowledge of academic reading and technical vocabularies.
CO2-POa	High	Gather deep knowledge of the techniques involving academic article writing.
CO-2-POl	Low	Apply this skill in academic fields throughout the entire life.
CO3-POi	Medium	Communicate in a team and adapt with the diversity of human nature.
CO3-POj	High	Build string communication skills within shortest possible time.
CO4-POb	Medium	Able to analyse the complexity of a critical situation and derive solution.
CO4-POd	Medium	Able to investigate through the problem to achieve a better understanding of the problem.
CO4-POj	High	Able to communicate with people to provide a significant conclusion.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Student-Centered Learning	42
Self-Directed Learning	

Non-face-to-face learning Revision Assessment Preparations	- - -
Formal Assessment Continuous Assessment Final Examination	 4 -
Total	88\

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Class	Topic	Rmks
1	Lab 1	Reading Comprehension: Practice using different techniques	
2	Lab 2	Academic reading: comprehension from departmental or subject related passages	
3	Lab 3	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary	
4	Lab 4	Writing semi-formal, Formal/official letters, Official E-mail Applying for a job: Writing Cover Letter and Curriculum Vitae	
5	Lab 5	Statement of Purpose (SOP) writing: writing steps, principles and techniques, outlining, revising, editing, proofreading;	
6	Lab 6	Proposal writing: writing steps, principles and techniques, outlining, revising, editing, proofreading;	
7	Lab 7	Report writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing; Article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing;	
8	Lab 8	Analyzing and describing graphs or charts	
9	Lab 9	Practicing analytical and argumentative writing	
10	Lab 10	Public Speaking: Basic elements and qualities of a good public speaker	
11	Lab 11	Set Speech: How to get ready for any speech.	
12	Lab 12	Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing power point slides, etc. Selected books/Selected stories for presentation.	
13	Lab 13	Listening to long lecture on some topics	
14	Lab 14	Listening and understanding speeches/lectures of different accents	

ASSESSMENT STRATEGY

Components		**Grading**	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Participation	20%	CO1, CO2, CO4	C2, C3
	Reading Test	15%	CO1, CO2	C2
	Listening Test	15%	CO1, CO3, CO4	C2, C4, C3
	Public Speaking	20%	CO2, CO3, CO4	C2, C3, C4
Group Presentation		30%	CO1-CO4	C2,C3,C4

Total Marks	100%	

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication
4. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
5. Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
6. Speak like Churchill stand like Lincoln - James C. Humes
7. Cambridge IELTS Practice Book
8. Selected Sample Reports and Selected Research Articles

REFERENCE SITE

MATH-205: Differential Equation, Laplace transform and Fourier Transform

COURSE INFORMATION

Course Code Course Title	: Math-205 : Differential Equations, Laplace Transform and Fourier Transform	Lecture Contact Hours Credit Hours	:3.00 : 3.00

PRE-REQUISITE

Math 101, Math 105

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To teach the students concepts, principles and operations of differential equation, Laplace transform and application of Fourier analysis in engineering problem. The aim of this course is to develop analytical and practical capability of learner on differential equation, Laplace transform and Fourier analysis.

OBJECTIVE

1. To provide a physical interpretation of the Differential Equations and Laplace Transform.
2. To explain the characteristics of Ordinary Differential Equations and Laplace Transform.
3. To apply Laplace and Fourier Transform in solving complex problems.
4. To use differential operations for simplification of complex engineering expressions

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Bloom's Taxonomy	PO	CP	CA	KP	Assessment Methods
CO1	Define various types of differential equations	C1	1	1,3	-	1,3	T, F
CO2	Apply techniques of finding Laplace's transform of different periodic functions	C2	1			3	T, Mid Term Exam, F

CO3	Analyze real and complex functions by Fourier analysis	C4	1			3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Differential Equations (DE): Introduction to DE, formulation of DE, degree and order of Ordinary Differential Equation(ODE), solution of first order DE by various methods, solution of higher order ODE, application of ODE, Frobenious methods, Bessel's functions, Legendre's polynomial and its application to engineering problem; formation of partial differential equations, linear and non-linear first order Partial Differential Equation(PDE), standard form Linear Equations (LE) of higher order, linear PDE with constant coefficients, equation of second order with variable coefficients, wave equation, particular solutions with boundary and initial condition, integral surface passing through given curve, non-linear PDE of order one, Charpit's method, second order PDE and classification to canonical solution, applications of PDE.

Laplace Transform (LT): Definition and properties of Laplace transform, sufficient conditions for existence of Laplace transforms, Laplace transform of some basic functions, LT of derivatives, unit step function, periodic function, some special theorems on LT, inverse Laplace transform, Heaviside expansion formula, convolution theorem, evaluation of improper integral, solution of differential equations by LT, application of LT.

Fourier Transform: Real and complex form of Fourier series, definition and expansion of a function of x in a Fourier series, physical application of Fourier series, finite Fourier transform, Fourier integral, inverse Fourier transform, Fourier transform and their uses in solving boundary value problems.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define various types of differential equations	H											
CO2	Apply techniques of finding Laplace's transform of different periodic functions	H											
CO3	Analyze real and complex functions by Fourier analysis	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The knowledge of mathematics and engineering sciences has to be applied to describe the operation of different aspects of engineering problem.
CO2-POa	High	To interpret the average, mean and standard deviation of an experiment, the knowledge of sciences is needed.
CO3-POa	High	To analyze real and complex functions knowledge of mathematics and engineering sciences has to be applied

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture	42

Practial/Tutorial / Studio Student-Centred Learning	-- --
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and discussion, Co-operative and collaborative method, Problem based method

COURSE SCHEDULE

Week	Lecture	Topic	Assessment
1	Lec 1 Lec 2 Lec 3	**Differential Equations** Introduction to DE, Formulation of DE, Degree and order of ODE Solution of first order DE by various methods Solution of first order DE by various methods	CT – 1, Final
2	Lec 4 Lec 5 Lec 6	Solution of first order DE by various methods, Solution of first order but higher degree DE, solution of general LEs of second and higher order Solution of Euler's homogeneous linear DEs	
3	Lec 7 Lec 8 Lec 9	Solution of DEs by methods based on factorization, Frobenious methods – concept Frobenious methods – problems	
4	Lec 10 Lec 11 Lec 12	Solution of differential equations of the higher order when dependent and independent variables are absent Bessel's functions, Legendre's polynomial, Power series solution of DE and their application, Integral form of DE and its application to engineering problem,	Midterm, Final
5	Lec 13 Lec 14 Lec 15	Formation of partial differential equations, linear and non-linear first order PDE, Standard form LEs of higher order Integral surface passing through given curve	
6	Lec 16 Lec 17 Lec 18	Non-linear PDE of order one, Charpit's method. Linear PDE with constant coefficients Linear PDE with constant coefficients	
7	Lec 19 Lec 20 lec 21	Equation of second order with variable coefficients, Second order PDE and classification to canonical solution wave equation, particular solutions with boundary and initial condition, Application of ODE, Applications of PDE	
8	Lec 22 Lec 23 Lec 24	**Laplace Transform** Definition and properties of Laplace transform Sufficient conditions for existence of Laplace transforms Laplace transform of some basic functions, LT of derivatives	CT – 2, Final
9	Lec 25 Lec 26 Lec 27	Unit step function, Periodic function Some special theorems on LT Inverse Laplace transform	

10	Lec 28 Lec 29 Lec 30	Partial fraction, Heaviside expansion formula Convolution theorem	
11	Lec 31 Lec 32 Lec 33	Evaluation of improper integral, Solution of Differential Equations by LT Application of LT	CT – 3, FINAL
12	Lec 34 Lec 35 Lec 36	**Fourier Transform** Real and Complex form of Fourier Series Definition and expansion of a function of x in a Fourier Series Physical application of Fourier Series	
13	Lec 37 Lec 38 Lec 39	Finite Fourier Transform Fourier Integral Inverse Fourier transform	FINAL
14	Lec 40 Lec 41 Lec 42	Fourier transform and their uses in solving boundary value problems Fourier transform and their uses in solving boundary value problems Diffusion, wave, Laplace Equation	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO3	C4
	Attendance	5%	-	-
	Observation	5%	CO3	C4
	Mid term	10%	CO2, CO3	C2, C4
Final Exam		60%	CO 1	C1, C2
			CO 2	C2, C4
			CO 3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain)

TEXT BOOKS

1. Ordinary and Partial Differential Equations by M.d.Raisinghania.
2. Differential Equations by Shepley L. Ross.
3. Laplace Transforms- Schaum's Outline Series, Murray R. Spiegel
4. Fourier Analysis With application to Boundary Value Problems by Murray R. Spiegel

REFERENCE BOOKS

1. Differential Equations by Glen R. Hall.
2. A Student's Guide to Laplace's Transforms by Deniel Fleisch

REFERENCE SITE

LEVEL-2 FALL TERM

CSE-213: Computer Architecture

COURSE INFORMATION			
Course Code	: CSE 213	Lecture Contact Hours	: 3.00
Course Title	: Computer Architecture	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: CSE-103
Course Title: Digital Logic Design

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to introduce 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. This course addresses the construction, design, and functionality of machines. It is easier, faster, less expensive, and more efficient to design, develop, and implement programs when one will know what's inside and how it works.

OBJECTIVE

1. To develop the basic idea about computer architecture
2. To learn the techniques of high performed parallel processing systems.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the Overview, Computer System, Arithmetic and logic, Central processing unit and parallel organization.	C2	-	-	3,4	MT, F
CO2	Understand Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.	C2, C4			3,4	MT, F
CO3	Illustrate instruction set architectures and subsystems of central processing unit.	C4			3,4	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Fundamentals of Computer Organization and Architecture: Fundamentals of computer Design, Processor Design, Computer Evolution and Performance, Processor Design; **Computer Function and Interconnection:** overview of computer BUS standards; **Multiprocessors**: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters; **Cache Memory**: Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 Cache Organization, ARM Cache Organization; **Internal Memory** : Memory organization, ARM Cache Organization, cache, Error Correction, virtual memory, channels; Concepts of DMA and Interrupts, Advanced DRAM Organization; **External Memory**: Magnetic Disk, RAID, Solid State Drives, Optical Memory, Magnetic Tape; **Input/ Output**: External Devices, I/O Modules, Programmed I/O, Interrupt Driven I/O, Direct Memory Access, I/O Channels and Processors, Thunderbolt and Infini Band; **Operating System Support**: Operating System Overview, Scheduling, Memory Management, Pentium Memory Management, ARM Memory Management; Number Systems, Computer Arithmetic, Machine Instruction Characteristics, Types of Operands, Types of Operations; Processor Structure and Function**;** **Processor design**: datapaths – single-cycle and multi-cycle implementations; **Control Unit design**: hardwired and micro-programmed; Hazards; Exceptions; Reduced Instruction Set Computers; RISC Processor; **Pipeline**: pipelined datapath and control, superscalar and dynamic pipelining; **Parallel Processing**: Instruction-Level Parallelism and Machine Parallelism, Instruction Issue Policy, Register Renaming, Machine Parallelism, Branch Prediction; **Superscalar Processors**: Superscalar Execution,

Superscalar Implementation; **Parallel Organization**: Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI Protocol, Multithreading and Chip Multiprocessors, Clusters, Non-uniform Memory Access, Vector Computation.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the Overview, Computer System, Arithmetic and logic, Central processing unit and parallel organization	H											
CO2	Understand Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.		H										
CO3	Illustrate instruction set architectures and subsystems of central processing unit.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth & depth of knowledge through understanding the structure of computer architectures.
CO2-POb	High	Understand and solve various complex problems by analysing processor design, hazards and exceptions.
CO3-POb	High	Understand and implement the design issues of instruction set architecture and subsystems of central processing unit.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2 Lec 3	Fundamentals of Computer Organization and Architecture: Fundamentals of computer Design, Processor Design	Class Test 1
2	Lec 4	Computer Evolution and Performance, Processor Design	

	Lec 5 Lec 6		
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	
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 Lec 15	Internal Memory: Memory organization, ARM Cache Organization, cache, Error 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, 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	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Number Systems, Computer Arithmetic, Machine Instruction Characteristics, Types of Operands, Types of Operations	
10	Lec 28 Lec 29 Lec 30	Processor Structure and Function; Processor design: datapaths, single-cycle and multi-cycle implementations; Control Unit design - hardwired and microprogrammed; Hazards; Exceptions;	
11	Lec 31 Lec 32 Lec 33	Reduced Instruction Set Computers; RISC Processor, Pipeline: pipelined datapath and control, superscalar and dynamic pipelining	Class Test 3
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, Non-Uniform Memory Access, Vector Computation	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
	Test 1-3	20%	-	-
			-	-

Continuous Assessment (40%)	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1/ CO2/ CO3	C2, C4
Final Exam		60%	CO1/ CO2/ CO3	C2, C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Computer Organization and Architecture, 9th Edition – William Stalling
2. Computer Organization and Design, 4th Edition – David A Patterson
3. Structured Computer Organization, 6th Edition – Andrew S. Tanenbaum

REFERENCE SITE

CSE-215: Data Structures & Algorithms II

COURSE INFORMATION

Course Code	:	CSE 215	Lecture Contact Hours	: 3.00
Course Title	:	Data Structures & Algorithms II	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: CSE-101, CSE 105, CSE-203
Course Title: Discrete Mathematics, Structured Programming Language, Data structure and Algorithm-I

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The course is designed to focus on basic and essential topics in data structures and algorithms, including different types of trees, heap, trie, disjoint set, greedy algorithms, dynamic programming, sorting algorithms, flow networks, string matching algorithms, graph sorting, backtracking, algorithm analysis and approximation algorithms.

OBJECTIVE

1. To use the data structures in different types of algorithms
2. To choose the appropriate algorithm based one scenario and constraints

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be familiar with commonly used data structures and algorithms.	C	1,3	-		T
CO2	Apply required modification and optimization in any data structure and algorithm in common engineering design.	C			3	MT
CO3	Illustrate important algorithmic design paradigms and methods of analysis.	C			3	T, F
CO4	Analyse the running time complexity and correctness of any algorithm.	C			2,3	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Trees: Heap, Priority Queue, AVL Tree, TRIE; **Set-List:** Disjoint set, Skip List; **Greedy Strategy:** Dijkstra's algorithm; **Dynamic Programming:** Bellman Ford's algorithm, Matrix chain multiplication, 0-1 knapsack, Longest common subsequence finding; Mergesort, Quicksort; **Flow network:** Maximum flow problem; Graph Sorting: Directed Acyclic Graph, Topological sorting; **Backtracking:** Map coloring problem, 0-1 Knapsack by branch and bound; **Solving Recurrences:** Algorithm analysis, Master theorem; **Approximation Algorithms:** NP Completeness

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Be familiar with commonly used data structures and algorithms.	H											
CO2	Apply required modification and optimization in any data structure and algorithm in common engineering design.			H									
CO3	Illustrate important algorithmic design paradigms and methods of analysis.		H										
CO4	Analyse the running time complexity and correctness of any algorithm.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth and depth of knowledge by being familiar with commonly used data structures and algorithms.
CO2-POc	High	Understand and implement the required data structures and algorithms with required modifications based on the scenario.
CO3-POb	High	Analyse and formulate different methods of analysis to illustrate important algorithmic design paradigms.
CO4-POb	High	Analyse the time complexity and correctness of any algorithm by using different analytical approaches

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Heap	Class Test 1
2	Lec 4 Lec 5 Lec 6	Priority Queue using Heap	
3	Lec 7 Lec 8 Lec 9	TRIE	
4	Lec 10 Lec 11 Lec 12	AVL Tree	Class Test 2
5	Lec 13 Lec 14 Lec 15	Dijkstra ‘s Algorithm, Bellman Ford Algorithm	
6	Lec 16 Lec 17 Lec 18	Fractional Knapsack, 0-1 Knapsack	
7	Lec 19 Lec 20 Lec 21	Longest Common Subsequence Finding	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Matrix Chain Multiplication	
9	Lec 25 Lec 26 Lec 27	Mergesort, Quicksort	
10	Lec 28 Lec 29 Lec 30	Flow Network	
11	Lec 31 Lec 32 Lec 33	Directed Acyclic Graph, Topological Sort, Strongly Connected Components	Class Test 3
12	Lec 34 Lec 35 Lec 36	Map Coloring Problem, 0-1 Knapsack by Branch and Bound	
13	Lec 37 Lec 38 Lec 39	Algorithm Analysis, Master Theorem	
14	Lec 40 Lec 41 Lec 42	NP Completeness Approximation Algorithms	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO3	C2-C5
	Class Attendance	5%	-	-

	Class Performance	5%	-	-
	Mid term	10%	CO2	C2-C6
Final Exam		60%	CO3	C2-C5
			CO4	C2-C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to Algorithms (Third Edition), Thomas H. Cormen
2. Data Structures and Algorithm Analysis in Cpp (Fourth Edition) – Michael T. Goodrich, Roberto Tamassia

REFERENCE SITE

CSE-216: Data Structures and Algorithms-II Sessional

COURSE INFORMATION

Course Code	:	CSE-216	Lecture Contact Hours	: 3.00
Course Title	:	Data Structures & Algorithms II Sessional	Credit Hours	: 1.50

PRE-REQUISITE

Course Code: CSE 106
Course Title: Structured Programming Language Sessional

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Data Structure and Algorithm-II course is designed to provide hands on implementation of commonly used data structures and algorithms. The lab begins with the implementation of some commonly used data structures and then covers the implementation of some important algorithms with required modifications and optimizations.

OBJECTIVE

1. To implement some commonly used data structure
2. To implement some commonly used algorithms with required modifications based on requirements

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the implementation of any data structure or algorithm	C2	1,2,3	5,3	3	Q
CO2	Implement any algorithm from its pseudo code	C2			3	T, ASG
CO3	Choose appropriate data structure and algorithm at the appropriate scenario	C3, C4			4	FT
CO4	Apply changes and modifications in the existing data structures and algorithms to reduce the time and space complexity of any problem	C3-C6			5	T, FT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Data Structure: Heap-Priority Queue, TRIE; Greedy Method: Dijkstra's Algorithm, Bellman Ford;

Dynamic Programming: Matrix Chain Multiplication, Longest Common Subsequence, 0-1 Knapsack; Divide and Conquer: Quick Sort, Merge sort; Pattern Matching: KMP Algorithm; Flow Network: Ford Fulkerson‘s Algorithm; Graph Searching and Sorting: Topological Sort, Finding Strongly Connected Components; Backtracking: 0-1 Knapsack

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the implementation of any data structure or algorithm	H											
CO2	Implement any algorithm from its pseudo code.		L										
CO3	Choose appropriate data structure and algorithm at the appropriate scenario		H										
CO4	Apply changes and modifications in the existing data structures and algorithms to reduce the time and space complexity of any problem			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth and depth of knowledge by understanding the implementation of any data structure or algorithm
CO2-POb	Low	Improving the skill of analyzing a problem by implementing any algorithm from its pseudo code
CO3-POb	High	Analyze and formulate different methods of analysis to determine appropriate algorithm to solve the problem
CO4-POc	High	Understand and implement algorithms for applying required changes and modifications in the existing data structures and algorithms which solutions have previously been identified and coded

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	4
Final Examination	3
Total	49

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lab 1	Quick Sort, Merge Sort	
2	Lab 2	Heap, Priority Queue	
3	Lab 3	TRIE	
4	Lab 4	Bellman Ford and Dijkastra (Shortest path algorithm)	
5	Lab 5	0-1 Knapsack	
6	Lab 6	LCS	
7	Lab 7	MCM	
8	Lab 8	Online 1	
9	Lab 9	Greedy Algorithms (Activity Selection, Job Sequencing Problem)	
10	Lab 10	Backtracking (Sum of Subsets, N Queen Problem, Map Coloring Problem)	
11	Lab 11	Topological Sort	
12	Lab 12	Ford Fulkerson ‘s Algorithm	
13	Lab 13	Branch and Bound (0-1 Knapsack)	
14	Lab 14	Online 2 and Quiz	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Evaluation	30%	CO2, CO4	C2, C3-C6
Final Test: Online 1 and 2	50%	CO3, CO4	C3-C6
Quiz	20%	CO1	C2
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

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

REFERENCE SITE

CSE-220: Object Oriented Programming Language Sessional-II

COURSE INFORMATION			
Course Code	: CSE-220	Lecture Contact Hours	: 4.00
Course Title	: Object Oriented Programming Language Sessional-II	Credit Hours	: 2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Object-oriented programming course is designed to provide a comprehensive knowledge about Inheritance, Polymorphism, and Encapsulation to do programming in an 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

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify the concept of OOP with a pure object-oriented programming language (Java).	P1, P2	1,3,7	1,5	1, 3, 4	E, Q
CO2	Identify and express how to use advanced programming features such as GUI design, exception handling and multi-threading.	P3, P4			6	O, PR
CO3	Demonstrate how to design and develop a complete real-world software solution.	C3, P5			5	PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Object-Oriented Programming (JAVA): Basic concepts on java, basic operation, command line, objects and classes in Java, class inheritance, polymorphism, exception handling, abstract classes, interfaces, Java Array, String, JAVA I/O (serialization) and stream, Generic Class and methods; Collection Frameworks; Concurrency; GUI: Swing components and swing Layouts.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify the concept of OOP with a pure object-oriented programming language (Java).	H											
CO2	Identify and express how to use advance programming features such as GUI design, exception handling and multi-threading.					M							

CO3	Demonstrate how to design and develop a complete real-world software solution.			H									
(H – High, M- Medium, L-low)													

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	In order to apply the knowledge of mathematics, science, engineering specializations, one must be able to identify the concept of OOP with a pure object-oriented programming language.
CO2-POe	Medium	In order to select, create, apply appropriate techniques, resources, one need to be able to express how to use advance programming features such as GUI design, exception handling and multi-threading
CO3-POc	Medium	In order to design solutions for complex engineering problems, one need to demonstrate how to design and develop a complete real-world software solution

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	56
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	4
Final Examination	4
Total	64

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lab 1	Fundamental Programming Concept in Java, basic operation. InteliJ/ Netbeans/ Eclipse Installation; Command Line, Java IO; If else; Loop; String; Array	
2	Lab 2	OOP concept; Classes, Access specifier, Package	
3	Lab 3	Java Inheritance	
4	Lab 4	Data Structure in Java	
5	Lab 5	Project Proposal	
6	Lab 6	Polymorphism; Generic Class and Methods, Concurrency	
7	Lab 7	Online 1	
8	Lab 8	Project Update 1	

9	Lab 9	GUI: Introduction with swings, Swing Layouts, JavaFX
10	Lab 10	String Buffer, StringBuilder, File I/O
11	Lab 11	Project Update 2
12	Lab 12	Exception Handling, Threading
13	Lab 13	Online 2, Quiz
14	Lab 14	Final Project Submission

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Class Evaluation/ participation	10%	CO1, CO2	P1, P2, P3
Online 1 + Online 2	40%	CO1, CO2	P1, P2, P3
Project Proposal	10%	CO3	C3, P5
Final Project	25%	CO2, CO3	P3, P4, C3
Quiz	15%	CO1	P1, P2
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Java, The Complete Reference (9th ed) - Herbert Schildt (2014)
2. Introduction To Java Programming Comprehensive Version 10th Edition - Y. Daniel Liang

REFERENCE SITE

CSE-219: Mathematical Analysis for Computer Science

COURSE INFORMATION

Course Code	:	CSE 219	Lecture Contact Hours	: 3.00
Course Title	:	Mathematical Analysis for Computer Science	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is aimed to gain introductory knowledge on probability, computation of probability with its practical and theoretical application in studying computer science.

OBJECTIVE

4. To learn mathematical models and methods to analyze problems that arise in computer science.
5. To understanding basics of probability theorem, the concept of random variable, standard distributions in discrete and continuous cases.
6. To learn the application of stochastic process and Queuing theory.

LEARNING OUTCOMES & GENERIC SKILLS						
No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Analysis of computational problem using mathematical models and methods	C	1	-	2	MT, F
CO2	Apply the basics of probability theorem, concept of discrete and continuous random variable with their distribution	C			2	MT, F
CO3	Apply concepts of expectations of different random variables	C			2	MT, F
CO4	Apply stochastic process and Queuing theory	C			2	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Recurrence Problem: Tower of Hanoi, Lines in the plane, Josephus problem; **Special Numbers**; **Generating Functions**; **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), Hidden Markov Model; Queuing models (birth-death model, Monrovian model), open and closed queuing network; Application of queuing models.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Analysis of computational problem using mathematical models and methods	H											
CO2	Apply the basics of probability theorem, concept of discrete and continuous random variable with their distribution	H											
CO3	Apply concepts of expectations of different random variables	H											
CO4	Apply stochastic process and Queuing theory	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	It requires analysis of problems using mathematics and engineering fundamentals to build mathematical models.
CO2-POa	High	Concept of probabilistic knowledge will increase the analytic capability in discrete and continuous domain to solve complex problems in engineering domain.
CO3-POa	High	Application of expectation of random variables will help to solve engineering problem in terms of the behaviors of any system by acquiring insight of the problem.
CO4-POa	High	Application of stochastic process and Queuing theory enable to develop solutions for different problem

<table>
<tr><th colspan="2">TEACHING LEARNING STRATEGY</th></tr>
<tr><td>Teaching and Learning Activities</td><td>Engagement (hours)</td></tr>
<tr><td>Face-to-Face Learning
Lecture
Practical / Tutorial / Studio
Student-Centred Learning</td><td>
42
-
-</td></tr>
<tr><td>Self-Directed Learning
Non-face-to-face learning
Revision
Assessment Preparations</td><td>
42
21
21</td></tr>
<tr><td>Formal Assessment
Continuous Assessment
Final Examination</td><td>
2
3</td></tr>
<tr><td>Total</td><td>131</td></tr>
<tr><th colspan="2">TEACHING METHODOLOGY</th></tr>
<tr><td colspan="2">Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method</td></tr>
</table>

<table>
<tr><th colspan="4">COURSE SCHEDULE</th></tr>
<tr><th>Week</th><th>Lecture</th><th>Topics</th><th>Assessment Methods</th></tr>
<tr><td>1</td><td>Lec 1
Lec 2
Lec 3</td><td>Recurrence Problems: The Tower of Hanoi
Lines in The Plane - 1
Lines in The Plane - 2</td><td rowspan="3">Class Test 1</td></tr>
<tr><td>2</td><td>Lec 4
Lec 5
Lec 6</td><td>The Josephus Problem-1
The Josephus Problem-2
Special Numbers: Stirling Numbers-1</td></tr>
<tr><td>3</td><td>Lec 7
Lec 8
Lec 9</td><td>Special Numbers: Stirling Numbers-2
Eulerian Numbers
Harmonic Numbers</td></tr>
<tr><td>4</td><td>Lec 10
Lec 11
Lec 12</td><td>Generating Functions-1</td><td rowspan="4">Class Test 2</td></tr>
<tr><td>5</td><td>Lec 13
Lec 14
Lec 15</td><td>Introduction to Probability: Conditional Probability
Independent Probability
Bayes’ Formula</td></tr>
<tr><td>6</td><td>Lec 16
Lec 17
Lec 18</td><td>Discrete Random variables
The Bernoulli Random Variable</td></tr>
<tr><td>7</td><td>Lec 19
Lec 20
Lec 21</td><td>The Binomial Random Variable
The Geometric Random Variable
The Poisson Random Variable</td></tr>
<tr><td>8</td><td>Lec 22
Lec 23
Lec 24</td><td>Continuous Random variables
The Uniform Random Variable
Exponential Random Variables</td><td rowspan="3">Mid Term Exam</td></tr>
<tr><td>9</td><td>Lec 25
Lec 26
Lec 27</td><td>Gamma Random Variables
Normal Random Variables
Expectation of a Random Variable: The Discrete Case</td></tr>
<tr><td>10</td><td>Lec 28
Lec 29
Lec 30</td><td>Expectation of a Random Variable: The Continuous Case
Variance
Stochastic Process: Definition with application</td></tr>
</table>

11	Lec 31 Lec 32 Lec 33	Markov chains Transforming a Process into a Markov Chain Chapman–Kolmogorov Equations	Class Test 3
12	Lec 34 Lec 35 Lec 36	Hidden Markov Model: Modeling	
13	Lec 37 Lec 38 Lec 39	Queuing models Birth-death model Monrovian model	
14	Lec 40 Lec 41 Lec 42	Open and closed queuing network Application of queuing models	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	-	-
			-	-
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1/-CO2	C
Final Exam		60%	CO1- CO4	C
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

EECE-279: Digital Electronics and Pulse Techniques

COURSE INFORMATION

Course Code	:	EECE-279	Lecture Contact Hours	: 3.00
Course Title	:	Digital Electronics and Pulse Techniques	Credit Hours	: 3.00

PRE-REQUISITE

Pre-study of CSE 103 (DLD) and EECE 169 (Electronic Devices and Circuits) is strongly recommended.

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE
This course is designed i) To provide the fundamental concepts that underlie the physical construction, operation, and analysis of digital integrated logic gates. ii) To provide an understanding of how to analyze, build and troubleshoot digital logic circuits. iii) To provide an understanding of pulse generation and problems in transmitting it. iv) To provide an understanding of memory elements.
OBJECTIVE
1. To know the operation and the structure of switching circuits. 2. To design and construct the logic families --- TTL, ECL, and MOS/CMOS. 3. To know pulse generation and transmission. 4. To understand construction of memory elements.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify the structure of various logic families and interpret its application in digital design	C2	2	-	1,3	CT, M, F
CO2	Design various pulse generation circuits and their application to logic circuits.	C6			1,5	CT, M, F
CO3	Understand, Analyze and Design the circuits of different memory elements.	C4			1,5	CT, M, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

a) DIGITAL ELECTRONICS:

i) Digital Electronics of Logic Gates: Review of diodes and transistors as switching devices, Digital Logic Families --- DTL, TTL, ECL and MOS, CMOS Logic families with operation details; Characteristics of Digital ICs: Propagation delay, Power dissipation, Figure of Merit, Fan in, Fan out, and Noise immunity; Open Collector/Drain and High Impedance gates,

ii) Linear Wave Shaping Techniques using Diodes --- clipping and clamping circuits, Comparator Circuits

iii) Electronic Circuits for Flip Flops, Electronic circuit of memory systems --- RAMs, ROMs and PLAs;

iv) A/D and D/A Converters with Applications, S/H circuits;

b) PULSE TECHNIQUES:

i) Pulse Generation--- Monostable and Astable Multivibrator circuits using transistors, op-amps, logic gates and 555/556 timer chips; Schmitt Trigger circuits;

ii) Pulse transmission---the effects on transmitting step, pulse and square waves through simple RC, RL and RLC circuits.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify the structure of various logic families and interpret its application in digital design.	H											
CO2	Design various pulse generation circuits and their application to logic circuits.			H									
CO3	Understand, Analyze and Design the circuits of different memory elements.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Basic knowledge of logic circuits is required to differentiate among various logic families and comprehend their application in regards of designing digital circuits.
CO2-POc	High	Competence to generate solutions for designing various pulse generation and transmission circuits and their application to logic circuits.
CO3-POc	High	Ability to Understand, Analyze and Design the circuits of different memory elements.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Subject and Syllabus Overview of switching characteristics of Diodes, Diode Logic (OR and AND) Gates and its operation Overview of switching characteristics of Transistors, Transistor Gates (NOT, NOR and NAND gates)	Class Test 1
2	Lec 4 Lec 5 Lec 6	IC Terminologies. Characteristics of Digital ICs: Propagation delay, Power dissipation, Figure of Merit, Fan in, Fan out, and Noise immunity DTL IC circuits, Digital Logic Families: TTL with operation details	
3	Lec 7 Lec 8 Lec 9	Digital Logic Families: TTL with operation details (continue…) Open Collector and High Impedance Gates TTL ICs, Subfamilies of TTL	
4	Lec 10 Lec 11 Lec 12	Linear Wave Shaping: High-pass & Low-pass circuits	Class Test 2
5	Lec 13 Lec 14 Lec 15	Clipping Circuits Clamping Circuits Comparator and Switching Circuits	
6	Lec 16 Lec 17 Lec 18	Digital Logic Families: ECL with operation details ECL (continue…), IIL MOS NOT, NOR and NAND gates	

7	Lec 19 Lec 20 Lec 21	CMOS NOT, NOR and NAND gates MOS and CMOS characteristics Interfacing between logic families	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Bi-stable Multivibrator, Schmitt Trigger Pulse Generation: Mono-stable and Astable Multivibrator	
9	Lec 25 Lec 26 Lec 27	Electronic Circuits for Flip Flops Electronic Circuits for Counters and Registers	
10	Lec 28 Lec 29 Lec 30	Electronic Circuits for Counters and Registers Electronic Circuits for Memory Systems ROM circuits	Class Test 3
11	Lec 31 Lec 32 Lec 33	RAM circuits Electronic Circuits for PLAs D/A Converters with Applications	
12	Lec 34 Lec 35 Lec 36	D/A Converters with Applications A/D Converters with Applications	
13	Lec 37 Lec 38 Lec 39	S/H circuits Non-linear applications of OPAMPs Timing circuits	
14	Lec 40 Lec 41 Lec 42	Timing circuits: An IC Timer (555 IC) Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO2	C6
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO2, CO3	C6, C4
Final Exam		60%	CO1- CO3	C1, C2, C6, C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Jacob Millman & Herbert Taub, Pulse, Digital and Switching Waveforms.
2. Ronald J Tocci, Digital Systems: Principles and Applications
3. Herbert Taub & Donald Schilling, Digital Integrated Electronics
4. Robert Coughlin & Frederick Driscoll, Operational Amplifiers and Linear Integrated Circuits

REFERENCE SITE

EECE-280: Digital Electronics and Pulse Techniques Sessional

COURSE INFORMATION			
Course Code	: EECE-280	Lecture Contact Hours	: 3.00 hrs in alternate week
Course Title	: Digital Electronics and Pulse Techniques Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: EECE-279
Course Title: Digital Electronics and Pulse Techniques

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed
i) To prove the fundamental concepts that underlie the construction, operation, and analysis of digital logic gates.
ii) To provide an understanding of how to analyze, build and troubleshoot digital logic circuits.
iii) To provide an understanding of pulse generation and problems in transmitting it.
iv) To provide an understanding of memory elements.

OBJECTIVE

1. To design and construct the logic gates using diodes and transistors.
2. To design and construct pulse generation circuits and study the problems in pulse transmission.
3. To construct circuits for basic memory elements.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	To design and construct logic gates using diodes and transistors.	P3	1, 3	-	3	Expt, R, Q, T
CO2	To design and construct pulse generation circuits and study the problems in pulse transmission.	P3			2,3,5,6	Expt, R, Q, T
CO3	To construct circuits for basic memory elements.	A3			6	Expt, R, Q, T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; Expt – Lab experiment, LT - Lab Test; Q – Quiz)

COURSE CONTENT

In this course, students will perform experiments to practically verify the theories and concepts learned in EECE 279 using different hardware equipment.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	To design and construct logic gates using diodes and transistors.	H											
CO2	To design and construct pulse generation circuits and study the problems in pulse transmission.		H										
CO3	To construct circuits for basic memory elements.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications

CO1-POa	High	Practical knowledge of how logic gates are constructed and comprehend their applications in designing digital circuit is required to understand digital logic gates.
CO2-POb	High	Knowledge of pulse generation and transmission is fundamental in using digital logic gates.
CO3-POc	High	Ability to design basic memory elements for digital circuits is very much needed.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	21
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	5
Final Examination	3
Total	50

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1	Lec 1	1. Study of DL circuits 2. Study of DTL circuits
2	Lec 2	3. Study of diode clipping circuits 4. Study of diode clamping circuits
3	Lec 3	5. Study of high-pass circuits
4	Lec 4	6. Study of low-pass circuits
5	Lec 5	7. Study of memory circuits (Flip-flops)
6	Lec 6	Practice
7	Lec 7	Lab Test + Quiz

ASSESSMENT STRATEGY

<table>
<tr><th colspan="2">Components</th><th>Grading</th><th>CO</th><th>Bloom's Taxonomy</th></tr>
<tr><td rowspan="7">Continuous Assessment (40%)</td><td rowspan="2">Class Observation</td><td rowspan="2">5%</td><td>CO1</td><td rowspan="12">C1, C2, C4, C6</td></tr>
<tr><td>CO2</td></tr>
<tr><td rowspan="3">Report</td><td rowspan="3">15%</td><td>CO1</td></tr>
<tr><td>CO2</td></tr>
<tr><td>CO3</td></tr>
<tr><td rowspan="2">Class Performance</td><td rowspan="2">25%</td><td>CO2</td></tr>
<tr><td>CO3</td></tr>
<tr><td colspan="2" rowspan="3">Labtest</td><td rowspan="3">30%</td><td>CO1</td></tr>
<tr><td>CO2</td></tr>
<tr><td>CO3</td></tr>
<tr><td colspan="2" rowspan="2">Quiz</td><td rowspan="2">25%</td><td>CO1</td></tr>
<tr><td>CO2</td></tr>
<tr><td colspan="2">Total Marks</td><td colspan="3">100%</td></tr>
</table>

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS
REFERENCE SITE

GELM-275: Leadership and Management

COURSE INFORMATION				
Course Code	: GELM-275	Lecture Contact Hours	: 2.00
Course Title	: Leadership and Management	Credit Hours	: 2.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The course is designed to make students understand the overlapping connection between engineering and management in an organization through the study of varied management practices and leadership traits as an engineer.
OBJECTIVE
7. To introduce different management functions and approaches. 8. To expose students to different views and styles of leadership 9. To understand how an organization functions collaboratively with managers and engineers. 10. To understand various personality traits and its impact on leadership and management. 11. To solve real-world management problems as an engineer.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Familiarize with the fundamental concepts of leadership and management skills	C1-C2	-	-	1	T, Pr, F
CO2	Understand the role and contribution of a leader in achieving organizational goals	C1-C2			1	T, ASG, R, F
CO3	Understand the contribution of leadership traits and management skills in decision making and solving real life problems	C1-C2			1	T, ASG, R, F

CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to Leadership and Management: Definition of leadership and management, basic difference between a leader and a manager, relation of leaders and managers with respect to efficiency and effectiveness, qualities of leader and managers with examples from history; **Management Fundamentals:** Definition of management & manager, levels of management, management functions and skills, Mintzberg's managerial roles, Henri Fayol's management principles, strategic management; **Leadership & Motivation**: Motivation, Maslow's hierarchy needs, theory of X & Y, motivators and hygiene factors, goal setting theory, reinforcement theory, equity theory, expectancy theory, Leadership styles, leadership trait theory, managerial grid, contemporary leadership, conflicts negotiation, leadership issues in 21st century, cross cultural leadership, engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning); **Organizational Management:** Organization, departmentalization, chain of command, unity of command, cross functional area, authority, centralization and decentralization, traditional & contemporary organization, matrix project structure, learning structure, organizing collaboration; **Planning and goal setting:** Foundation of planning; goals of plan, types of goal, types of goal & plan, goal setting, MBO, well written goal; **Control:** Controlling process, controlling for organizational performance, types of control: (feed-forward, feedback & concurrent), balanced scorecard, contemporary issues in control, workplace concern & workplace violence, **Change and Innovation:** Change and innovation, internal and external for change, changing process, creativity vs innovation; **Attitude:** Components of Attitude, behaviour model and characteristics model; behaviour vs. attitude, job attitude, job involvement, job satisfaction and customer satisfaction; **Personality:** Personality determinants: heredity and environment, Myers-Briggs Type Indicator, Big five personality model, personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking, proactive personality); **Perception and Individual Decision Making**: Factors influencing perception, attribution theory, errors/biases in attribution, Factors of individual decision making, rational decision making, bounded rationality, satisfice, common errors in decision making, creativity in decision making; **Understanding Work Team:** Work group, work team, problem solving team, self-managed work team, cross functional team, virtual team, team effectiveness, team challenges; **HR Management:** Process of Human Resource Planning, forecasting demand for labour, staffing, internal supply of labour, performance appraisal; **Operations Management:** Project managing basics, goals and boundary of project, WBS, scheduling a project, Demand and supply forecasting, inventory control; **Information Technology and Management:** Management Information System (MIS), Enterprise Resource Planning (ERP) - For introductory knowledge;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Familiarize with the fundamental concepts of leadership and management skills	H											
CO2	Understand the role and contribution of a leader in achieving organizational goals											H	
CO3	Understand the contribution of leadership traits and management skills in decision making and solving real life problems												H

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	By knowing the basic concepts of leadership and management skills, engineering knowledge will be enriched
CO2-POk	High	Management of an organization and cost will be learned to achieve leader's targets
CO3-POl	High	Decision making skill will help to gain a lifelong learning

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28

Revision	14
Assessment Preparations	14
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2	**Introduction to Leadership and Management:** Definition of leadership and management; basic difference between a leader and a manager; relation of leaders and managers with respect to efficiency and effectiveness; qualities of leader and managers with examples from history. **Management Fundamentals:** Definition of management & manager; levels of management; management functions and skills; Mintzberg's managerial roles; Henri Fayol's management principles; strategic management.	Class Test 1
2	Lec 3 Lec 4	**Leadership & Motivation**: Motivation, Maslow's hierarchy needs; theory of X & Y; motivators and hygiene factors; goal setting theory; reinforcement theory; equity theory; expectancy theory	
3	Lec 5 Lec 6	**Leadership:** Leadership styles; leadership trait theory; managerial grid; contemporary leadership; conflicts negotiation; leadership issues in 21st century; cross cultural leadership; engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).	
4	Lec 7 Lec 8	**Case Study – I: Engineer as Great Leaders**	
5	Lec 9 Lec 10	**Organizational Management:** Organization; departmentalization; chain of command; unity of command; cross functional area; authority; centralization and decentralization; traditional & contemporary organization; matrix project structure; learning structure; organizing collaboration. **Planning and goal setting:** Foundation of planning; goals of plan; types of goal; types of goal & plan; goal setting; MBO; well written goal.	
6	Lec 11 Lec 12	**Control:** Controlling process; controlling for organizational performance; types of control: (feed-forward, feedback & concurrent); balanced scorecard; contemporary issues in control; workplace concern & workplace violence. **Change and Innovation:** Change and innovation; internal and external for change; changing process; creativity vs innovation.	
7	Lec 13 Lec 14	**Case Study – II: Planning and Goal Setting; A Managerial Approach: Engineer as Great Managers (Interactive Discussions in the Class)** **Attitude:** Components of Attitude; behavior model and characteristics model; behavior vs. attitude; job attitude; job involvement; job satisfaction and customer satisfaction.	

8	Lec 15 Lec 16	**Personality:** Personality determinants: heredity and environment; Myers-Briggs Type Indicator; Big five personality model; personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking, proactive personality). **Perception and Individual Decision Making**: Factors influencing perception; attribution theory; errors/biases in attribution	Mid Term Exam/ Project
9	Lec 17 Lec 18	**Perception and Individual Decision Making**: Factors of individual decision making; rational decision making; bounded rationality; satisfice; common errors in decision making; creativity in decision making. **Case Study – III: A Case on Decision Making – Involves both leadership and managerial skills (Interactive Discussion in the Class)**	
10	Lec 19 Lec 20	**Understanding Work Team:** Work group; work team; problem solving team; self-managed work team; cross functional team; virtual team; team effectiveness; team challenges. **HR Management:** Process of Human Resource Planning; forecasting demand for labor; staffing.	Class Test 2
11	Lec 21 Lec 22	**HR Management:** Internal supply of labor; performance appraisal. **Operations Management:** Project managing basics; goals and boundary of project; WBS; scheduling a project.	
12	Lec 23 Lec 24	**Operations Management:** Demand and supply forecasting; inventory control. **Exercise – Use of Microsoft Project (MSP) for scheduling a project at student level**	
13	Lec 25 Lec 26	**Case Study – IV:** A case that covers all relevant theories taught throughout the course and involves both leadership and management issues, e.g., Columbia's Final Mission. (This may be given as group assignment followed by in class short presentations/discussions)	
14	Lec 27 Lec 30	**Information Technology and Management:** Management Information System (MIS); Enterprise Resource Planning (ERP) - For introductory knowledge. **Revision**	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C2, P1
			CO2	C1-C2
	Presentation	5%	CO1	C1-C2, P1, A1
	Class Attendance	5%	-	-
	Mid term	10%	CO1	C1-C2, P1, A1
			CO2	C1-C2, P1-P2, A1-A2
			CO3	C1-C2, P1-P2, A1-A2
Final Exam		60%	CO1	C1-C2, P1, A1
			CO2	C1-C2, P1-P2, A1-A2
			CO3	C1-C2, P1-P2, A1-A2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS
1. Gupta, A. K. Engineering Management. India, S. Chand Publishing, 2014. **2.** Telsang, Martand. Industrial Engineering and Production Management: For Undergraduate, Postgraduate Courses and Diploma Programmes in Mechanical, Production and Industrial Engineering Students. A Useful Guide for HE, Management Courses, Professional Engineers and Competitive Examinations for GATE and UPSC and Engineering Services Examinations. S. Chand, 2006. **3.** Yukl, Gary. Leadership in Organizations, 9/e. Pearson Education India, 1981. **4.** Whetten, David Allred, Kim S. Cameron, and Mike Woods. Developing management skills. Upper Saddle River, NJ: Prentice Hall, 2007.
REFERENCE SITE

MATH-207: Complex Variable and Statistics

COURSE INFORMATION				
Course Code	:	MATH-207	Lecture Contact Hours	: 3.00
Course Title	:	Complex Variables and Statistics	Credit Hours	: 3.00

PRE-REQUISITE
Course Code: MATH 101, MATH 103 Course Title: Differential and Integral Calculus, Differential Equations and Matrix
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course is designed to teach the students about concepts, principles of complex variables and statistics. It is targeted to provide a basic foundation for mathematics areas Complex number system, grouped sample data hypothesis etc. Finally, this course is designed to develop a capability of solving real life problems through complex variables and statistics.
OBJECTIVE
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Define complex number system, complex functions	C1	1	-	1	T, F, ASG
CO2	Explain the concept of a frequency distribution, Skewness, Kurtosis, grouped sampled data etc.	C2			1, 2	T, MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Complex Variables: 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 a complex function, Cauchy's integral formula, Liouville's theorem, Taylor's and Laurent's series, residues, Cauchy's residue theorem. **Statistics**: Measures of central tendency, standard deviation, Chebychev's theorem, z-scores, frequency distribution, graphical representation of data including stem, leaf and box plot, moments, skewness, kurtosis, elementary sampling theory, treatment of grouped sampled data, estimation, tests of hypothesis, regression and correlation.

SKILL MAPPING													
No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define complex number system, complex functions	H											
CO2	Explain the concept of a frequency distribution, Skewness, Kurtosis, grouped sampled data etc.	H											
(H – High, M- Medium, L-low)													

JUSTIFICATION FOR CO-PO MAPPING:		
Mapping	Level	Justifications
CO1-POa	High	The knowledge of mathematics and engineering sciences has to be applied to describe the operation of different aspects of engineering problem.
CO2 -POa	High	To interpret the average, mean and standard deviation of an experiment, the knowledge of sciences is needed.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Complex number system, General functions of a complex variable, Basic operations on complex numbers and variables	Class Test 1
2	Lec 4 Lec 5 Lec 6	Absolute value property and complex conjugate, Limits of a function of complex variable and related theorems	
3	Lec 7 Lec 8 Lec 9	Continuity of a function of complex variable and related theorems, Complex function, Polar form of complex numbers	
4	Lec 10 Lec 11 Lec 12	Graphical representation in polar form, Differentiation and the Cauchy-Riemann Equations	Class Test 2
5	Lec 13 Lec 14 Lec 15	Line integral of a complex function, Liouville ‘s Theorem	
6	Lec 16 Lec 17	Cauchy ‘s Integral Formula, Taylor ‘s Theorem, Laurent ‘s Theorem	

	Lec 18		
7	Lec 19 Lec 20 Lec 21	Singular Residues, Cauchy ‘s Residue Theorem	
8	Lec 22 Lec 23 Lec 24	Introduction to Statistics, Measures of central tendency, standard deviation	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Chebyche’s theorem z- cores, Frequency distribution	
10	Lec 28 Lec 29 Lec 30	Graphic, representation of data including stem, leaf and box plot, moments	
11	Lec 31 Lec 32 Lec 33	Treatment of grouped sampled data, estimation	Class Test 3
12	Lec 34 Lec 35 Lec 36	Skewness, elementary sampling theory	
13	Lec 37 Lec 38 Lec 39	Kurtosis, regression and correlation	
14	Lec 40 Lec 41 Lec 42	Tests of hypothesis	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	CO1, CO2	C1, C2
			CO1	C1, C2
	Class Attendance	5%	-	-
	Observation	5%	CO1	C1, C2
	Mid term	10%	CO2	C2
Final Exam		60%	CO1	C1, C2
			CO2	C2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT BOOKS

1. Complex variables - Schaum’s Out-line Series
2. Complex variables – M. L. Khanna
3. Statistics- Schaum’s Outline Series- Murray R. Spiegel, Larry J. Stephen
4. Statistics- Dr. S. Sachdeva

REFERENCE BOOKS

1. Complex variables A Physical Approach with Applications – Steven G. Krantz
2. Statistics and Random Processes - B. Praba, Aruna Chalam and Sujatha
3. Probability and Statistics for Engineers- Schaeffer & McClave

REFERENCE SITE

LEVEL-3 SPRING TERM

CSE-301: Database Management Systems

COURSE INFORMATION			
Course Code	: CSE 301	Lecture Contact Hours	: 3.00
Course Title	: Database Management Systems	Credit Hours	: 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
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 the concepts and application of a Relational Database System. 4. Be familiar with relational database theory, and be able to write relational algebra expressions for queries.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Describe the basic concepts, applications, and design of database systems.	C	1,3,7	-	3	MT, FT
CO2	Illustrate the basics of SQL and construct queries using SQL.	C			3	MT, FT
CO3	Analyze real life scenarios and suggest solutions based on the concepts and application of a Relational Database System with proper reasoning.	C			5,6	FT
CO4	Be familiar with relational database theory and be able to write relational algebra expressions for queries.	C			3	FT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, FT- Final Term, T – Test, MT-Mid Term)

COURSE CONTENT

Introduction of database systems: Concepts, Applications and Objective; 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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Describe the basic concepts, applications,	H											

	and design of database systems.												
CO2	Illustrate the basics of SQL and construct queries using SQL.		H										
CO3	Analyze real life scenarios and suggest solutions based on the concepts and application of a Relational Database System with proper reasoning.			H									
CO4	Be familiar with relational database theory and be able to write relational algebra expressions for queries.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Able to understand the basic concept and application of database systems.
CO2-POb	High	Apply the SQL concept to solve complex queries using database project.
CO3-POc	High	Understand the basic concept of commercial project with the help of SQL queries and comparison techniques to evaluate the working performance.
CO4-POb	High	Able to understand and translate the SQL queries in relational algebra expression.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
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	SQL	Class Test 2

	Lec 11 Lec 12		
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	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Transaction manager	
10	Lec 28 Lec 29 Lec 30	Concurrency controller, Recovery manager	
11	Lec 31 Lec 32 Lec 33	Security system, Database administration	Class Test 3
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	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	-	-
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1, CO2	
Final Exam		60%	CO1	C
			CO2	C
			CO3	C
			CO4	C
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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, AddisonWesley

3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, Third edition
REFERENCE SITE

CSE-302: Database Management Systems Sessional

COURSE INFORMATION				
Course Code	:	CSE-302	Lecture Contact Hours	: 3.00
Course Title	:	Database Management Systems Sessional	Credit Hours	: 1.50

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
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.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate the knowledge in projects with a commercial relational database system (Oracle) and design a team-based project.	C2-C3, C6	1,3,6,7	1,3, 5,2	5,6	PR
CO2	Utilize the database design principles, SQL and PL SQL.	C2, P6			3,6	T, CE
CO3	Demonstrate the relational database theory and be able to develop and write relational algebra expressions for queries.	C1-C3, P4			5,6	PR, Q
CO4	Develop the communication skill by presenting topics on database management system.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)
COURSE CONTENT
SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate the knowledge in projects with a commercial relational			H									

	database system (Oracle) and design a team-based project.												
CO2	Utilize the database design principles, SQL and PL SQL.					H							
CO3	Demonstrate relational database theory and be able to develop and write relational algebra expressions for queries.	H											
CO4	Develop the communication skill by presenting topics on database management system.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POc	High	Design solutions for problems and design system components that meet the specified needs in projects with a commercial relational database system (Oracle)
CO2-POe	High	Demonstrate the whole project by illustrating with E-R diagram, schema diagram with related PL SQL and SQL queries.
CO3-POa	High	Apply and relate the relational algebra expression with related SQL queries.
CO4-POj	High	Develop communication skills through participating in viva, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Student-Centered Learning	-
Self-Directed Learning	
Project Preparations	21
Assessment Preparations	12
Formal Assessment	
Continuous Assessment	05
Final Examination	01
Project Assessment	02
Total	83

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1	Lab 1	Introduction, Oracle Installation
2	Lab 2	Table Creation, SQL
3	Lab 3	Simple Query
4	Lab 4	Data Expressions
5	Lab 5	Join
6	Lab 6	Constraints
7	Lab 7	Online 1
8	Lab 8	Advanced Query (GROUP Function etc.), Sub-queries
9	Lab 9	Single-row function, Numeric function, Manipulation function.
10	Lab 10	Conversion function, Nesting of function, Abstract data type etc.

11	Lab 11	Database Trigger/ Procedure
12	Lab 12	PL/SQL Packages, Indexing, View
13	Lab 13	Introduction to PL/SQL
14	Lab 14	Online 2 and Quiz

ASSESSMENT STRATEGY

Components			Grading	CO	Bloom's Taxonomy
Continuous Assessment (100%)	Class Performance and Observation		10%	CO1, CO4	C2, P6, A2
	Project	Project Proposal (15%)	50%	CO1, CO2, CO3	C2-C3, C6, P4, P6
		Project Update and Submission (35%)			
	Viva/ Quiz		10%	CO3	C1-C3, P4
	Online		30%	CO2	C2, P6
Total Marks			100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Database System Concept, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Fifth Edition
2. Oracle Database 11g The Complete Reference, Kevin Loney

REFERENCE SITE

CSE-303: Compiler

COURSE INFORMATION

Course Code	: CSE 303	Lecture Contact Hours	: 3.00
Course Title	: Compiler	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: CSE-217
Course Title: Theory of Computation

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Compiler course is designed to provide a knowledge how a compiler function. To teach the students the basic techniques that underlies the practice of various phases of Compiler construction.

OBJECTIVE

1. To understand various stages in compilation process.
2. To provide knowledge on designing scanner, parser.
3. To introduce the theory that can be employed in order to perform syntax-directed translation of a high-level programming language into an executable code.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the interdependencies of different phases of a compiler that work	C2	-	-	3,4	MT, FT

	together to translate high-level programming languages into target code.					
CO2	Apply various mechanisms in different phases of compilers to understand the language translation processes.	C3			3,4	MT, FT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, FT- Final Term, MT-Mid Term)

COURSE CONTENT

Introduction to compiling; Basic issues; Lexical analysis and Scanning: Specifications and Recognition of tokens, patterns and lexemes; Transition diagram based lexical analyzer; Syntax analysis; Syntax directed translation; Attribute Grammars and 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, Peep hole optimization, Optimization of basic blocks-Loops in flow graphs; Introduction to global data-flow analysis, Code improving transformation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the interdependencies of different phases of a compiler that work together to translate high-level programming languages into target code.	H											
CO2	Apply various mechanisms in different phases of compilers to understand the language translation processes. Apply various mechanisms in different phases of compilers to understand the language translation processes.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	It requires the application of engineering principles to understand the correlation of compilation process, thereby demonstrating the requirement of diverse knowledge to solve complex engineering problems.
CO2-POa	High	It requires students to utilize diverse knowledge areas in designing mechanisms essential for solving complex problems related to language translation in compiler construction.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21

Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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, Non-recursive 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	Mid Term Exam
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 28 Lec 29 Lec 30	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 31 Lec 32 Lec 33	Quadruples, Triples, Static Single Assignment Form, Types and Declarations	Class Test 3
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	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	-	-
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1, CO2	C2, C3
Final Exam		60%	CO1	C2
			CO2	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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).

REFERENCE SITE

CSE-304: Compiler Sessional

COURSE INFORMATION

Course Code	:	CSE 304	Lecture Contact Hours	: 3.00 hrs in alternative wk
Course Title	:	Compiler Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to implement tokenizer, arithmetic calculator and to able to write the code by using Flex and Bison.

OBJECTIVE

4. To learn to implement different phases of a compiler.
5. To learn the use of Flex and Bison tools used for designing a compiler.
6. To understand how to implement parsing techniques to solve problems.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Remember, understand and apply the basic techniques of compiler construction.	C1, C2, C3	1,3,7	-	3,4	ASG, CE

CO2	Understand the working mechanisms of flex and yacc tools.	C2, P4, A1			3,4	ASG, T
CO3	Analyze and adapt the new tools and technologies used for designing a compiler.	C4, P6, A2			6	ASG, T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; V - Viva; F – Final Exam; CE-Class Evaluation)

COURSE CONTENT

Symbol Table: Introduction to symbol table, **Tokenizer:** Tokenizer using Flex, Arithmetic Calculator Using Bison, **Intermediate Code Generator**: (Flex + Bison).

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Remember, understand and apply the basic techniques of compiler construction.	H											
CO2	Understand the working mechanisms of flex and yacc tools.	H											
CO3	Analyze and adapt the new tools and technologies used for designing a compiler.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	It requires students to apply their foundational knowledge of engineering fundamentals to construct compilers, demonstrating the practical integration of a diverse skill set to solve complex engineering problems in the domain of compiler construction.
CO2-POa	High	It ensures the practical application of engineering specialization and knowledge of tools to effectively address challenges in language translation
CO3-POe	High	It requires adapting the new tools and design a compiler using new technologies.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	14
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning in (Lab)	-
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	07
Final Examination	03
Total	45

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

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

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Online	25%	CO1	C1, C2, C3
			CO2	C2, P4, A1
			CO3	C4, P6, A2
	Quiz	20%	-	-
	Class Participation	10%	CO1	C1, C2, C3
	Offline/ Assignment	40%	CO1	C1, C2, C3
			CO2	C2, P4, A1
			CO3	C4, P6, A2
	Class Attendance	5%	-	-
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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).

REFERENCE SITE

CSE 305: Microprocessors, Microcontrollers and Assembly Language

COURSE INFORMATION				
Course Code	:	CSE 305	Lecture Contact Hours	: 3.00
Course Title	:	Microprocessors, Microcontrollers and Assembly	Credit Hours	: 3.00

PRE-REQUISITE
Course Code: CSE 201 Course Title: Digital Logic Design

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
This course is designed to teach students the concepts, principles and functioning of the basics of microprocessors, microcontrollers and assembly language. This course aims to provide a fundamental foundation of assembly language, microprocessor architecture, and discusses different interfaces and design of systems based on microprocessors and microcontrollers.

OBJECTIVE

12. To familiarize students with the architecture and operation of typical microprocessors and microcontrollers and impart knowledge on the low-level language of microprocessor.
13. To teach the basics of programming and interfacing of common microprocessors and microcontrollers.
14. To investigate in depth the microprocessor-based systems.
15. To provide a strong foundation for being able to design real world applications using microprocessors and microcontrollers.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Interpret microprocessor and microcontroller's internal architecture and their operation.	C1-C2	1.7	1,2	1,3,6	CT, MT, F
CO2	Analyze how the high-level language structure is converted to low level languages and how a processor executes a program line by line.	C4			3	CT, MT, F
CO3	Design programs to interface microprocessor to external devices and design a microcontroller-based system.	C3, C6			1,3,8	CT, MT, F
CO4	Apply knowledge and programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and solve assembly language programs.	C3, C5			3	CT, MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Microprocessors: Introduction to 16-bit, and 32-bit microprocessors --- their architectures, addressing modes, instruction set format, interrupts, multi-tasking and virtual memory; Memory interface; Bus interface; Integrating microprocessor with interfacing chips; Programmable peripheral interfacing chip Arithmetic co-processor; Overview of CISC and RISC processors. Microcontrollers: Introduction to Microprocessor and Microcontrollers, understanding their basic differences and applications. Introduction to the Architecture, memory organization, special function registers, I/O ports of latest popular microcontrollers like ATMEGA, Arduino, Raspbery PI etc. Assembly

Language: Basic Concepts; Assembly Language Fundamentals; assembly instruction types and their formats: Arithmetic, Logical, Transfer control and Conditional processing, String processing, Arrays, Procedures, Stacks, branches, Subroutine and parameter passing, Input/output and Interrupts.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Interpret microprocessor's and microcontroller's internal architecture and their operation.					H							
CO2	Analyze how the high-level language structure is converted to low level languages and how a processor executes a program line by line.	H											
CO3	Design programs to interface a microprocessor to external devices and design a microcontroller-based system.				L								
CO4	Apply knowledge and programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and solve assembly language programs.		M										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1- POe	High	Understand the level of appropriateness and wide usage of microprocessors and microcontrollers in computing systems.
CO2 - POa	Low	Gain depth of knowledge for analyzing low level language structure and their execution process.
CO3 – POd	Low	Preliminary level investigation and experimentation while designing programs to interface devices to microprocessor and microcontroller-based systems.
CO4 – POb	Medium	Do problem analysis for the target microprocessor and assembly programs while applying the gained knowledge.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY			
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2 Lec 3	System Architecture for Assembly language, Assembly programming basics	Class Test 1
2	Lec 4 Lec 5 Lec 6	Assembly Addressing modes, Assembly instruction types and their formats: Arithmetic and Logical processing	
3	Lec 7 Lec 8 Lec 9	Transfer control and conditional-processing, Stacks, Branches, Procedures	
4	Lec 10 Lec 11 Lec 12	String processing, Subroutine and parameter passing, Input/output, Interrupts	
5	Lec 13 Lec 14 Lec 15	Intro to Microprocessor and Microcontroller. Architectural overview of Microprocessor and its operation, Common instruction types and addressing modes	Class Test 2
6	Lec 16 Lec 17 Lec 18	Intel 8086 Microprocessor: Internal architecture, Register structure, Programming model	
7	Lec 19 Lec 20 Lec 21	Addressing modes, Instruction set; I/O Pin diagram and Control signals; I/O port organization and accessing	
8	Lec 22 Lec 23 Lec 24	Cache Memory, TLB Structure; Memory Management in Intel 80X86 Family: Segmentation and Real Mode Memory Management.	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Intel 80186, 80386 and 80486 segments register formats	
10	Lec 28 Lec 29 Lec 30	Interrupts and Exception in Intel 80X86 families of processors, type of Interrupts	
11	Lec 31 Lec 32 Lec 33	Interrupts in real mode and protected mode, Interrupts Priorities	
12	Lec 34 Lec 35 Lec 36	Input and Output: IO address spaces, Port organization, Memory mapped IO	Class Test 3
13	Lec 37 Lec 38 Lec 39	Hand-shaking IO instruction, Keyboard-Display interface Timer handler	
14	Lec 40 Lec 41 Lec 42	Microcontrollers: Architecture of a microcontroller, memory organization, I/O ports, Special function registers.	

ASSESSMENT STRATEGY				
Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	CO1	C1-C2
			CO2	C4
			CO3	C3, C6
			CO4	C3, C5
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO1	C1-C2
			CO4	C3, C5
Final Exam		60%	CO1	C1-C2
			CO2	C4
			CO3	C3, C6
			CO4	C3, C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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. A hands-on course in sensors using the Arduino and Raspberry Pi, by Ziemann & Volker, CRC Press.

REFERENCE SITE

CSE 306: Microprocessors, Microcontrollers and Assembly Language Sessional

COURSE INFORMATION				
Course Code	:	CSE-306	Lecture Contact Hours	: 3.00
Course Title	:	Microprocessors, Microcontrollers and Assembly Language Sessional	Credit Hours	: 1.50

PRE-REQUISITE

Course Code: CSE-305
Course Title: Microprocessors, Microcontrollers and Assembly Language

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This is a sessional course based on CSE305 which introduces hands-on practices on basics of programming microprocessor and microcontroller through its own instruction set and using assembly language, and practices interfaces to different peripheral devices. Students also learn to design systems based on microprocessors and microcontrollers.

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

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand how low-level languages are implemented and how a processor executes a program line by line.	C1-C3			1,8	E, O, L
CO2	Design basic assembly programs using microprocessor 8086 and interface with its associated components.	C1, C2, C3, C4, C6		1,2,3	1,5	E, O, Q/V
CO3	Experiment using a microcontroller in a group project.	C1-C4, C6			5	Pr, V, PR, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, E – Evaluation; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; L- Lab Test; O – Online; V - Viva)

COURSE CONTENT

Basics 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 modes** – 1D Array, DUP operator, Addressing-mode, register indirect mode, **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 or Arduino based microcontroller and simulation.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand how low-level languages are implemented and how a processor executes a program line by line.				M								
CO2	Design basic assembly programs using microprocessor 8086 and interface with its associated components.	H											
CO3	Experiment using a microcontroller in a group project.												H

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1 – POd	Medium	Will be able to investigate and experiment with low-level languages by writing programs.
CO2 -POa	High	Will gain breadth and depth of knowledge in illustrating how a basic microcomputer works with its associate components.

CO3 – POi	High	Will gain experience of teamwork and collaboration while working in the group project.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method, Hands-On Learning

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lab 1	Basic of Assembly Language - Compilation, input, output, variables, basic instructions, memory model, data segment, stack segment, code segment, Input Output Instruction	Class Participation
2	Lab 2	Flow Control Instruction - Conditional and unconditional jump instructions, If-then-else, case, for loop, while loop	Evaluation
3	Lab 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	Lab 4	Stack and Procedure - Push, Pushf, Pop, Popf Multiplication and Division – Mul, IMul, Div, IDiv	
5	Lab 5	Array and Addressing modes – 1D Array, DUP operator, Addressing-mode, register indirect mode	
6	Lab 6	String Instructions - Moving string, load string, scan string, compare string File Operations – File errors, opening and closing a file, r/w a file	
7	Lab 7	Online Exam	Online Test
8	Lab 8	Project Idea	Project
9	Lab 9	Basic Idea of MDA 8086 LED and Seven Segment display interface	Class Participation

10	Lab 10	Operation of DOT matrix using 8086 kit LCD interface with 8086	Evaluation
11	Lab 11	Keyboard interface with 8086 Motor interface with 8086	
12	Lab 12	Project Update	Project
13	Lab 13	Lab Exam	Lab Test
14	Lab 14	Final Project Submission and Quiz	Project, Quiz/Viva

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Class Evaluation	20%	CO1	C1-C3
			CO2	C1, C2, C3, C4, C6
	Class Participation	5%	CO1	C1- C3
			CO2	C1, C2, C3, C4, C6
Online Test		20%	CO1	C1-C3
Lab Test		20%	CO2	C1, C2, C3, C4, C6
Project Submission		25%	CO3	C1, C4, C6
Quiz / Viva		10%	CO1, CO2, CO3	C1, C2, C3, C4, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

CSE 307: Operating System

COURSE INFORMATION			
Course Code	: CSE-307	Lecture Contact Hours	:3.00
Course Title	: Operating System	Credit Hours	:3.00

PRE-REQUISITE

Course Code: CSE-213
Course Title: Computer Architecture

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Operating System (OS) course is designed to provide a comprehensive understanding to the modern Operating Systems. 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 service.

OBJECTIVE

1. To develop the basic idea about internals and design principles of Operating System.
2. To learn the techniques for achieving protection and security in multi-level complex environment.

LEARNING OUTCOMES & GENERIC SKILLS

<table>
<tr><th>No.</th><th>Course Learning Outcome
(Upon completion of the course, the students will be able to)</th><th>Bloom's Taxonomy</th><th>CP</th><th>CA</th><th>KP</th><th>Assessment Methods</th></tr>
<tr><td>CO1</td><td>Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.</td><td>C1-C4</td><td rowspan="4">1,2</td><td rowspan="4">1</td><td>3</td><td>T, MT, F</td></tr>
<tr><td>CO2</td><td>Understand and analyse process, thread, memory and file management systems.</td><td>C2, C4</td><td>3</td><td>T, MT, F</td></tr>
<tr><td>CO3</td><td>Understand and implement algorithms for process, thread, deadlock and memory management.</td><td>C2, C3</td><td>5</td><td>T, MT, F</td></tr>
<tr><td>CO4</td><td>Develop the communication skill by presenting developed projects and its implementation on operating systems.Develop the communication skill by presenting topics on operating systems.</td><td>A2</td><td></td><td>Pr</td></tr>
</table>

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

OS introduction: Introduction of Operating System, Types of OS; **Process:** process managements, process states, job and process scheduling, CPU scheduling algorithms, process coordination, critical section problems, semaphores, Inter-Process Communication (IPC), classical IPC problems, multiprocessing and time sharing; **Memory management:** swapping, memory allocation schemes, Paging and segmentation, virtual memory, page replacement strategies, working sets, demand paging; **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 and some project development on operating systems.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Classify, identify and analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.	H											
CO2	Understand and analyse process, thread, memory and file management systems.		H										
CO3	Understand and implement algorithms for process, thread, deadlock and memory management.			H									
CO4	Develop the communication skill by presenting developed projects topics on operating systems.												

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth & depth of knowledge through Classifying, identifying and analysing various aspect of modern operating systems.
CO2-POb	High	Understand and solve various complex problems by analysing process, thread, memory and file management system.
CO3-POc	High	Understand and implement algorithms for process, thread, deadlock and memory management which solutions have previously been identified and coded.
CO4-POj	Low	Develop communication skills through participating in quiz, project presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	File system functions file organization logical and physical file maps, tree structure filesystems	
9	Lec 25 Lec 26 Lec 27	I/O programming Device management techniques. Interrupts processing parallel processing.	
10	Lec 28 Lec 29 Lec 30	Secondary storage management, disk scheduling algorithms	
11	Lec 31 Lec 32 Lec 33	Space allocation, catalogs, file access control mechanism	Class Test 3
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 and project development on of some operating systems.	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C4
			CO 2	C2, C4
			CO 3	C2, C3
	Mid Term	10%	CO 1	C1-C4
			CO 2	C2, C4

			CO 3	C2, C3
	Class Performance	5%	CO4	A2
	Class Attendance	5%	-	-
Final Exam		60%	CO 1	C1-C4
			CO 2	C2, C4
			CO 3	C2, C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Modern Operating Systems (4th) - Andrew S. Tanenbaum; Prentice Hall
2. Operating Systems: Internals and Design Principles – (9th) -William Stallings
3. Operating System concepts - A. Silberschatz, P.B. Galvin, Greg Gagne

REFERENCE SITE

CSE-308: Operating System Sessional

COURSE INFORMATION

Course Code: Course Title:	: CSE 308 : Operating System Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Operating System (OS) Sessional course is designed to provide hands-on understanding on basic components of Operating Systems. The lab begins with the activities related to developing the development–understanding the utilization of operating systems like UNIX and WINDOWS. Subsequently the course deals with virtualization and different key components of Operating System e.g. kernel compilation, process and thread scheduling, deadlocks, memory management, synchronization and system calls, development and presentation of projects on operating systems etc.

OBJECTIVE

1. To learn basic OS concepts and to be familiar with the design principles of Operating System.
2. To know the internal and design principles of Operating System.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand and respond to major operating systems like Windows, Linux etc.	C2, A2		1,2	8	T, F, Q
CO2	Apply and modify algorithms for process, thread and memory management through group project work	C2, A2			6	ASG, F, Q

CO3	Develop the communication skill by presenting developed projects on operating systems	P3, A4			2	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction:–Understanding the utilization of Linux Operating System, Introduction to virtual machines, Installation of Linux in various modes, Installation of windows application programs on Linux, Basic Linux Command; **Linux Kernels and Office Environments:** Compilation; **Shell Programing:** variables, statements, loop, array, functions etc; **Memory management**: preemptive and non- preemptive algorithms and implementation; **Inter process communication and Process scheduling:** algorithms and implementation; **Mutual exclusion and deadlock:** algorithms and implementation; Development and presentation of project on operating systems.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand and respond to major operating systems like Windows, Linux etc.				H								
CO2	Apply and modify algorithms for process, thread and memory management through group project work									H			
CO3	Develop the communication skill by presenting developed projects topics on operating systems										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POd	High	Understand and respond major operating systems like Windows and Unix like OS through investigation and experimentation
CO2-POi	High	Apply and modify algorithms for process, thread and memory management as a group project work.
CO3-POj	High	Development and presentation of the project on operating systems. Develop the communication skill by presenting topics on operating systems.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Examination	3

Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab-1,2	Introduction of Linux Operating System, Installation of Linux in various modes, Installation of windows application programs on Linux, Basic Linux Command	3:00 hrs in alternate week
3	Lab-3,4	Compilation of Linux Kernels and Office Environments	
5	Lab-5,6	Variables, statements, loop, array, functions etc. in Shell Programing	
7	Lab-7,8	Preemptive and non- preemptive algorithms for process scheduling algorithms and implementation	
9	Lab-9,10	Inter process and thread communication, thread creation, thread management, thread synchronization	
11	Lab-11,12	Mutual exclusion and deadlock algorithms and implementation	
13	Lab-13,14	Developement and presentation of the project on operating systems. Presenting topics on operating systems	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	30%	CO1	C2, A2
			CO2	C3, A5
				C4, A3
	Class Participation	20%	CO3	P3, A4
	Presentation	10%	CO3	P3, A4
Final Exam (Quiz + Online Test)		40%	CO1, CO2	C2, C3, C4, A2, A5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Modern Operating Systems (4th) - Andrew S. Tanenbaum; Prentice Hall
2. UNIX Shell Programming - Kanetkar
3. Nachos Beginner's Guide - Saman Hadiani, Niklas Dahlbäck, and Uwe Assmann

REFERENCE SITE

CSE-317: Data Communication

COURSE INFORMATION				
Course Code	:	CSE-317	Lecture Contact Hours	:3.00
Course Title	:	Data Communication	Credit Hours	:3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
The main course is to infer 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. To familiarize with modern telecommunications and the architecture of a number of different networks.
2. To impart knowledge on protocol layering and different multiplexing techniques, data compression algorithms to optimize network bandwidth.
6. To familiarize with the use reliability, redundancy and availability of different techniques to meet network performance criteria.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Explain data communication system and its components.	C1-C2	1, 2,3	2, 5	1,3	T, Mid Term, F
CO2	Percept the digital and analogue representations of signals and analyze the mechanism of encoding schemas.	C4, P1			3	Mid Term Exam, F
CO3	Identify and analyze principles of security, performance and reliability of different networks.	C1, C4			2,6	Mid Term Exam, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Introduction: Communication Components, Protocols and Standards, OSI Model, TCP/IP Model. **Data Transmission Basics:** Analog and digital data, Periodic analog signals, Fourier Analysis, Digital signals, Transmission impairment, Data rate limits, Networks Performance measurement. **Data Encoding:** Line Coding, Block Coding, Scrambling, Pulse Code Modulation, Delta Modulation, Transmission Modes. **Analog Transmission:** Digital-To-Analog Conversion, Amplitude/Frequency/Phase Shift Keying, Quadrature Amplitude Modulation, Analog-to-Analog Conversion, Amplitude/Frequency/Phase Modulation. **Multiplexing:** Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum. **Transmission Media:** Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Radio Waves, Microwaves, Infrared. **Switching:** Circuit-Switched Networks, Datagram Networks, Virtual-Circuit Networks, Structure of a switch, Telephone Network and Dial-Up Modems. **Connecting Devices:** Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Gateway, Backbone Networks, Virtual LANs. **Wireless WANs:** cellular Telephone and Satellite Networks.

SKILL MAPPING													
No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Explain data communication system and its components.	H											
CO2	Percept the digital and analogue representations of signals and analyze the mechanism of encoding schemas.		H										
CO3	Identify and analyze principles of security, performance and reliability of different networks.		H										
(H – High, M- Medium, L-low)													

JUSTIFICATION FOR CO-PO MAPPING:		
Mapping	Level	Justifications
CO1-POa	High	Depth of engineering knowledge can be accomplished by understanding the data transmission system and its components and working principles.
CO2-POb	High	Complex problem analysis skill can be developed by analyzing different data encoding techniques.
CO3-POb	High	Evaluation of engineering system can be perceived through analyzing different security and performance measure of communication networks.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1	Introduction to the course, Introduction to data communication and networks, The Internet, Communication Components, Protocols and Standards.	Class Test 1
	Lec 2		
	Lec 3		
2	Lec 4	Network models, Layered tasks, OSI Model, Layers in the OSI model, TCP/IP protocol suite, Network addressing.	
	Lec 5		
	Lec 6		
3	Lec 7	Analog and digital data, Periodic analog signals. Fourier Analysis.	
	Lec 8		
	Lec 9		
4	Lec 10	Digital signals	Class Test 2

	Lec 11	Transmission impairment	
	Lec 12		
5	Lec 13	Data rate limits Networks Performance measurement	
	Lec 14		
	Lec 15		
6	Lec 16	Line Coding	
	Lec 17	Block Coding	
	Lec 18	Scrambling	
7	Lec 19	Pulse Code Modulation, Delta Modulation Transmission Modes	Mid Term Exam
	Lec 20		
	Lec 21		
8	Lec 22	Amplitude Shift Keying, Frequency Shift Keying Phase Shift Keying, Quadrature Amplitude Modulation	
	Lec 23		
	Lec 24		
9	Lec 25	Amplitude Modulation, Frequency Modulation, Phase Modulation Frequency-Division Multiplexing	
	Lec 26		
	Lec 27		
10	Lec 28	Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum	
	Lec 29		
	Lec 30		
11	Lec 31	Circuit-Switched Networks	Class Test 3
	Lec 32	Datagram Networks	
	Lec 33	Virtual-Circuit Networks	
12	Lec 34	Structure of a switch. Telephone Network and Dial-Up Modems. Guided and unguided media, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Radio Waves, Microwaves, Infrared.	
	Lec 35		
	Lec 36		
13	Lec 37	Telephone Network and Dial-Up Modems. Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers	
	Lec 38		
	Lec 39		
14	Lec 40	Three-Layer Switches, Gateway, Backbone Networks, Virtual LANs. Cellular Telephone, Satellite Networks.	
	Lec 41		
	Lec 42		

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C4, P1
			CO3	C1, C4
	Class Performance	5%	-	-
	Mid term	10%	CO1	C1, C2
			CO2	C4, P1
			CO3	C1, C4
	Class Attendance	5%	-	-
Final Exam		60%	CO1	C1, C2
			CO2	C4, P1
			CO3	C1, C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)
REFERENCE 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
REFERENCE SITE

CSE-318: Data Communication Sessional

COURSE INFORMATION				
Course Code	:	CSE-318	Lecture Contact Hours	:3.00 hrs in alternative wk
Course Title	:	Data Communication Sessional	Credit Hours	:0.75

PRE-REQUISITE
Course Code: CSE-317 Course Title: Data Communication
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The purpose of this sessional course is to impart empirical knowledge and hand-on experience on different topic of data communication based on CSE-317.
OBJECTIVE
3. To familiarize students with different network simulation technologies. 4. To impart practical knowledge on different signal modulation/demodulation and multiplexing techniques. 5. To bestow the quality of each data transmission methods using both signal processing devices and lab software 6. To impart the empirical knowledge on data link layer fundamentals, e.g., error detection, correction and flow control techniques.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Adopt data communication simulation technologies.	C3, C6,	1	1	6	Class Assessment
CO2	Compare each data transmission methods using both signal processing devices and lab software.	C2, C5,	3	5	2,3	Class Assessment, T, Q
CO3	Develop the empirical knowledge on data link layer fundamentals, e.g., error detection, correction and flow control techniques.	C5, C6	1	1	6	Online, Q, Obv

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment/Class Assessment; Pr – Presentation; R - Report; F – Final Exam, MT-Mid Term Exam, Obv - Class Observation)
COURSE CONTENT
Introduction to MATLAB: Amplitude Modulation, Frequency Modulation, Delta Modulation & Demodulation, **Digital to digital Conversion:** Line Coding / DSB-SC and SSB Demodulators, ASK/PSK/FSK, CDMA, Error Detection and Correction (Checksum).

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Adopt data communication simulation technologies.					H							
CO2	Compare each data transmission methods using both signal processing devices and lab software.		H										
CO3	Develop the empirical knowledge on data link layer fundamentals, e.g., error detection, correction and flow control techniques.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POe	High	Use of modern tools can be accomplished by adopting simulating technologies like MATLAB to network simulation.
CO2-POb	High	Identify and Analyse appropriate transmission methods using engineering sciences
CO3-POe	Medium	Use of modern tools can be accomplished by adopting simulating technologies to detect error

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	10
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	36

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lab - 1, 2	Introduction to MATLAB and signal processing libraries.	3.00 hrs in alternative wk
3	Lab - 3, 4	Amplitude Modulation, Frequency Modulation, Phase Modulation	
5	Lab - 5, 6	Delta Modulation and Demodulation.	
7	Lab - 7, 8	Evaluation 1 + Line Coding: DSB-SC and SSB Demodulators	
9	Lab - 9, 10	ASK, PSK, FSK	

11	Lab - 11, 12	Error Detection and Correction
13	Lab-13,14	Lab Test

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Class Assessment	30%	CO1	C3, C6, P6
			CO2	C2, C5, P7
			CO4	P4, C5, C6
	Online	30%	CO1	C3, C6, P6
			CO3	C2-C4
			CO4	P4, C5, C6
	Observation	10%	CO2	C4, P1
			CO3	C2-C4
			CO4	P4, C5, C6
Quiz		30%	CO1-CO4	C2-C6, P4, P7
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Data Communication and Networking (4th ed) - Behrouz A Forouzan (2017)
2. Introduction to MATLAB – zyBook

REFERENCE SITE

LEVEL-3 FALL TERM

CSE-309: Computer Network

COURSE INFORMATION			
Course Code	: CSE-309	Lecture Contact Hours	:3.00
Course Title	: Computer Network	Credit Hours	:3.00

PRE-REQUISITE

Course Code: CSE-317
Course Title: Data Communication

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to understand the organization of computer networks, factors influencing computer network development and the reasons for having a variety of different types of networks. Resource sharing, high Reliability, increase in system performance, and security in network are the main objectives.

OBJECTIVE

1. Understand different types of networks and proper placement of different layers of ISO model.
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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understanding different types of networks, the organization of computer networks, proper placement of different layers of ISO model and factors influencing network development.	C1-C2	1,5	-	1, 3	T, F
CO2	Illustrate knowledge of different techniques of error detection and correction to detect and solve error bits during data transmission.	P4			2	MT
CO3	Design network routing for IP networks using different routing protocol.	C3-C6			6	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Layered Architecture, Layers in the OSI Model; **Error Detection and Correction:** Redundancy, Hamming Distance, Parity Checks, CRC, Checksum, Hamming Code; **Data Link Control**: Framing, Flow and Error Control, Protocols for Noiseless Channels and Noisy Channels, HDLC, Point-to-Point Protocol; **Multiple Access**: Random Access, Controlled Access; **Wired LANS**: IEEE Standards, Standard Ethernet, Fast and Gigabit Ethernet; **SONET/SDH**: Architecture, Layers, SONET Frames, STS Multiplexing, SONET Networks; **Virtual-Circuit Networks**: frame Relay, ATM; **Network Layer**: IPv4 and IPv6 Address, Address Mapping, ICMP, IGMP, ICMPv6, Delivery and Forwarding, Unicast and Multicast Routing Protocols; **Transport Layer**: Process-to-process delivery, UDP, TCP; **Application Layer**: DNS, The Web and HTTP, FTP.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understanding different types of networks, the	H											

	organization of computer networks, proper placement of different layers of ISO model and factors influencing network development.												
CO2	Illustrate knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.		M										
CO3	Design network routing for IP networks using different routing protocols.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Able to understand different types of networks, the organization of networks, different layers of ISO model and factors influencing network development.
CO2-POb	Medium	Apply the knowledge of different techniques of error detection and correction to detect and solve error bits during data transmission.
CO3-POc	High	Able to design network routing for IP networks using different routing protocols.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1	Introduction	Class Test 1
	Lec 2	Layered Architecture, Their Service Models	
	Lec 3	Layers in the OSI Model	
2	Lec 4	Introduction to Error Detection and Correction	
	Lec 5	Redundancy, Hamming Distance	
	Lec 6	Parity Checks	
3	Lec 7	CRC	
	Lec 8	Checksum	
	Lec 9	Hamming Code	
4	Lec 10	Framing, Flow and Error Control	Class Test 2
	Lec 11	Protocols for Noiseless Channels	

	Lec 12		
5	Lec 13	Protocols for Noisy Channels HDLC, Point-to-Point Protocol	
	Lec 14		
	Lec 15		
6	Lec 16	Random Access and Controlled Access protocols	
	Lec 17		
	Lec 18		
7	Lec 19	IEE Standards, Standard Ethernet Fast and Gigabit Ethernet	Mid Term Exam
	Lec 20		
	Lec 21		
8	Lec 22	Architecture and Layers of SONET/SDH	
	Lec 23	SONET Frames	
	Lec 24	STS Multiplexing, SONET Networks	
9	Lec 25	Frame Relay of Virtual-Circuit Networks ATM	
	Lec 26		
	Lec 27		
10	Lec 28	IPv4 and IPv6 Address	
	Lec 29	Address Mapping	
	Lec 30	ICMP	
11	Lec 31	IGMP, ICMPv6	Class Test 3
	Lec 32	Delivery and Forwarding	
	Lec 33	Unicast and Multicast Routing Protocols	
12	Lec 34	Process-to-process delivery	
	Lec 35	UDP	
	Lec 36	TCP	
13	Lec 37	DNS, Email and its Privacy SNMP	
	Lec 38		
	Lec 39		
14	Lec 40	WWW, HTTP FTP	
	Lec 41		
	Lec 42		

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1, C2
	Class Performance	5%	-	-
	Class Attendance	5%	-	-
	Mid term	10%	CO 2	P4
Final Exam		60%	CO 1	C1, C2
			CO 3	C3-C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Data Communications and Networking - Behrouz Forouzan
2. Computer Networks - Andrew S. Tanenbaum
3. Complete Networking: A Top Down Approach Featuring the Internet - James F. Kurose, Keith W. Ross

REFERENCE SITE

CSE-310: Computer Network Sessional

COURSE INFORMATION				
Course Code	:	CSE 310	Lecture Contact Hours	: 3.00
Course Title	:	Computer Network Sessional	Credit Hours	: 1.50

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
Understand and analyze different network infrastructures, applications of different types of computer networks to facilitate communication and resource-sharing among a wide range of users.

OBJECTIVE

1. Understand and analyze different types of computer networks & simulate present contemporary and new protocols of computer networks.
2. Detects network vulnerabilities by capturing and analyzing real-time packets.
3. Achieve a basic idea about Cisco Packet tracer, WireShark, Ns2.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand and analyze different types of computer	C2, C4	1,3,4	-	1	Q
CO2	networks and create server client communication.	C6, P3			5	T, ASG
CO3	Design and simulate present contemporary and new	C3,C4			5	T
CO4	protocols of computer networks in Cisco Packet Tracer.	C4,A2			6	Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

IP Addressing, Basic Configuration of Cisco Packet Tracer, **Socket Programing**, Basic Network Configuration (**Static Routing**), **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 **Wire shark,** Introduction to **NS2**.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand and analyze different types of computer networks and create server client communication.	H											

CO2	Design and simulate present contemporary and new protocols of computer networks in Cisco Packet Tracer.			H									
CO3	Applying and analyzing different routing protocols of computer networks in physical devices.			H									
CO4	Capturing and analyzing real-time packets to detect vulnerability of network using Wire Shark.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Understand and analyze different types of computer networks and create server client communication.
CO2-POc	High	Simulate present contemporary and new protocols of computer networks in Cisco Packet Tracer and NS2
CO3-POc	High	Apply and analyze different routing protocols of computer networks in physical devices.
CO4-POe	High	Analyze real-time packets to detect networks using WireShark.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Self-Directed Learning	
Non-face-to-face learning Revision	-
Assessment Preparations	-
Non-face-to-face learning Revision	-
Formal Assessment	
Continuous Assessment	04
Final Examination	06
Total	52

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1	Lab 1	IP Addressing, Basic Configuration of Cisco Packet Tracer
2	Lab 2	Basic Network Configuration, Static Routing

3	Lab 3	Variable Length Subnet Mask (VLSM)
4	Lab 4	RIP, EIGRP
5	Lab 5	Open Shortest Path First (OSPF)
6	Lab 6	Dynamic Host Configuration Protocol (DHCP)
7	Lab 7	Online 1
8	Lab 8	Access Control List (ACL)
9	Lab 9	VLAN
10	Lab 10	Inter-VLAN, VTP
11	Lab 11	Physical Network Interface Connection/ Router
12	Lab 12	Information Gathering using Wire shark
13	Lab 13	Online 2
14	Lab 14	Quiz

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Final Exam	Online Test	25%	2	C6,
		25%	3	C3, C4
	Quiz	20%	1,4	C2, C4
Continuous Assessment (30%)	Class Performance	10%	2	C6
	Class Assessment	20%	2	C6
Total Marks		100%	2	

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Computer Networks - Andrew S. Tanenbaum
2. Complete Networking: A Top Down Approach Featuring the Internet – James F. Kurose, Keith W. Ross

REFERENCE SITE

CSE-315: Digital System Design

COURSE INFORMATION

Course Code	:	CSE-315	Lecture Contact Hours	: 2.00
Course Title	:	Digital System Design	Credit Hours	: 2.00

PRE-REQUISITE

Course Code: CSE-305
Course Title: Microprocessors, Micro-controllers and Assembly Language

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Digital System Design course deals with design of different components of basic computer and applying knowledge in the initial interfacing of basic computer.

OBJECTIVE

7. To provide a basic idea of the structure and interface of different components of Digital Computer Systems.
8. To design different components of basic computer.
9. To understand and design microprocessor of basic computer.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Design different components of a microcomputer like Accumulator, Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory.	C4-C6	1,2,3	1,5	5	F
CO2	Design a customized microprocessor with different instruction sets.	C4-C6, P3			5	F
CO3	Understand and describe the functionalities of diverse digital systems through the application of various methods.	C2, C5			3,4	MT

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Design of various components of a computer: Accumulator design, Shifter design, ALU, memory and control unit – hardwired and micro-programmed, Microprocessor based designs**;** Design using special purpose controllers. **Introduction to Simple As Possible** (Microprocessor)- Architecture, Instruction Set, Design, Microprogramming, SAP-1, SAP-2; **Design of memory subsystem using SRAM and DRAM;** destructive memory, non-destructive memory

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Design different components of a microcomputer like Accumulator, Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory.			H									
CO2	Design a customized microprocessor with different instruction sets.			H									
CO3	Understand and describe the functionalities of diverse digital systems through the application of various methods.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POc	High	Analyze, evaluate and design complex components of a microcomputer to meet desired specifications and needs with appropriate consideration of the structure and environment of the microcomputer.
CO2-POc	High	It requires analyzing and designing customized microprocessors with different instruction sets, and the ability to design a complex computing

		system to meet desired specifications considering the standards and environment of the computing system..
CO3-POa	High	It requires understanding and describing the functionalities of a digital system using various methods and knowledge of engineering fundamentals as well as engineering specializations.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28
Revision	14
Assessment Preparations	14
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2	Introduction to Arithmetic and shift operations	Class Test 1
2	Lec 3 Lec 4	Design of various components of a computer	
3	Lec 5 Lec 6	Design ALU: Arithmetic unit	
4	Lec 7 Lec 8	Design ALU: Logic unit, Design of flag registers comparator	Class Test 2
5	Lec 9 Lec 10	Accumulator design, processor unit	
6	Lec 11 Lec 12	Control Logic design, Combinational and sequential circuit design with PLA's,	
7	Lec 13 Lec 14	Control unit - hardwired and micro-programmed, Microprocessor based designs	Mid Term Exam
8	Lec 15 Lec 16	Introduction to Simple As Possible 1 (Microprocessor)-Architecture, Instruction Set	
9	Lec 17 Lec 18	Simple As Possible-1: Instruction Design	
10	Lec 19 Lec 20	Simple As Possible-1: Control unit design	
11	Lec 21 Lec 22	Simple as Possible-2: Architecture, Arithmetic Instruction Set	Class Test 3
12	Lec 23 Lec 24	Simple as Possible-2: Logic Instruction Set	
13	Lec 25 Lec 26	Simple as Possible-2: Programming using instructions	
14	Lec 27 Lec 28	Design of memory subsystem using SRAM and DRAM	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	-	-
	Class Attendance	5%	-	-
	Class Performance	5%	-	-
	Mid term	10%	CO3	C2, C5
Final Exam		60%	CO1	C4-C6
			CO2	C4-C6, P3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Digital Logic and Computer Design - M. Morris Manno
2. Digital Computer Architecture – Malvino, Brown

REFERENCE SITE

CSE-316: Digital System Design Sessional

COURSE INFORMATION			
Course Code	: CSE-316	Lecture Contact Hours	:3.00 hrs in alternative wk
Course Title	: Digital System Design Sessional	Credit Hours	:0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Digital System Design Sessional course deals with design of different components of basic computers and fully customized microprocessors of basic computers.

OBJECTIVE

1. To design different components of basic computer
2. To understand and design the microprocessor of a basic computer.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO 1	Design different components of the microprocessor using the concept of computer system design and simulate it using simulation software.	C4-C6	1,2,3,7	1,2,5	5	PR, R
CO 2	Design and implement a customized microprocessor with special features and	C4-C6, P4			5	PR, R

	simulate it using simulation software with team presentation.					
CO 3	Function efficiently both independently and as a participant in teams.	-			-	V
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile PR – Project; Q – Quiz; R - Report; V - Viva)						

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, and Control Unit.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO 1	Design different components of the microprocessor using the concept of computer system design and simulate it using simulation software.			H									
CO 2	Design and implement a customized microprocessor with special features and simulate it using simulation software with team presentation.			H									
CO 3	Function efficiently both independently and as a participant in teams.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POc	High	Analyze, evaluate and design different complex components of a microcomputer to meet desired specifications and needs with appropriate consideration of the structure and environment of the digital systems.
CO3-POc	High	Design solutions, components or processes that meet specified needs with appropriate consideration for a customized microprocessor with specific instruction set considering the standards and environment of a computing system.
CO4-POi	High	Practice to work in teams for designing and implementation of digital systems with special features and submission as group assignments.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	7
Final Examination	-
Total	49

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lab-1	Introduction to digital system and software simulation, Problem definition of Project: Design of a Shifter	3:00 hrs in alternate week
3	Lab-2	Submission of Shifter (Software Simulation and Hardware Implementation), Problem definition of Project: Design of an ALU	
5	Lab-3	Design submission and software simulation of ALU	
7	Lab-4	Final project submission of ALU with report, Problem definition of Project: Design of a 4-bit microprocessor	
9	Lab-5	Design submission of 4-bit microprocessor	
11	Lab-6	Hardware implementation submission of 4-bit microprocessor without control unit, Full software simulation of 4-bit microprocessor	
13	Lab-7	Final project submission of 4-bit microprocessor with report	

ASSESSMENT STRATEGY

Components			**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Design	Design	10%	CO 1	C4-C6
				CO 2	C4-C6, P4
	Implementation	Simulation	10%	CO 1	C4-C6
				CO 2	C4-C6, P4
	Viva/Presentation		20%	CO 3	
	Report		10%	CO 1	C4-C6
				CO 2	C4-C6, P4
Quiz			20%	-	-
Total Marks			100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Digital Logic and Computer Design - M. Morris Manno
2. Digital Computer Architecture – Malvino, Brown

REFERENCE SITE

CSE-319: Software Engineering

COURSE INFORMATION			
Course Code Course Title	: CSE-319 : Software Engineering	Lecture Contact Hours Credit Hours	: 3.00 : 3.00
PREREQUISITE			
Course Code: Nil Course Title: Nil			

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Software Engineering course is designed to provide a general introduction to software engineering and design. This course will introduce important concepts such as software processes and agile methods, essential software development activities from initial software specification through to system evolution. Apart from these, this course will also introduce the important topics including dependability, security, and project management.

OBJECTIVE

1. To understand the process of designing, building, and maintaining software systems.
2. To acquire the skill of software project management.
3. To understand software evolution, testing approaches and quality assurance to ensure high standard/professional software.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand and apply the fundamentals of the software development process.	C1 - C3	1,2,3,4	-	3	T, F
CO2	Analyze the user requirements, and design different kinds of system and architectural models for building software systems.	C4, C6			4,5	T, MT, F
CO3	Develop testing mechanisms for assuring the quality of the software.	C4, C5			5	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Concepts of software engineering: different phases of software; **Professional software development ethics:** software development ethics; **Software processes:** software process models, process activities; **Agile software development:** agile methods, plan-driven and agile development; **Requirements engineering:** functional and non-functional requirements, software requirements document, requirement specification, requirement elicitation and analysis; **System modeling:** context model, interaction models, structural models, behavioral models, model-driven engineering; **Architectural design:** architectural views and patterns, application architectures; **Design and implementation:** object oriented design, design patterns; **Software testing:** development testing, test-driven development, release testing, user testing; **Software quality:** quality attributes, software quality assurance, product metrics; **System dependabilityand reliability engineering:** dependability properties, availability and reliability, dependability engineering; **Introduction to project management:** risk management, managing people, teamwork.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1	Understand and apply the fundamentals of the software development process.	H											

CO2	Analyze the user requirements, and design different kinds of system and architectural models for building software systems.		H										
CO3	Develop testing mechanisms for assuring the quality of the software.				M								

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Acquire a strong level of knowledge regarding software engineering by understanding the fundamental concept of software engineering like software engineering principles, software development process, agile development process, software quality,.
CO2-POb	High	Comprehend system analysis, interpret system requirements, and grasp software development fundamentals to identify user requirements. Subsequently, engage in designing both software architecture and system models. Acquire knowledge related to the ability to design, analyze, and interpret a software system, leading to the development of complex system architectures and models.
CO3-POd	Medium	Develop complex software systems in accordance with the specifications in order to assure the quality and dependability of a software through an in-depth knowledge of software testing mechanisms.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2 Lec 3	Introduction to software engineering Introduction to software engineering (Contd.) Introduction to software engineering (Contd.)	Class Test 1
2	Lec 4 Lec 5 Lec 6	Professional SW development ethics Professional SW development ethics (Contd.) Professional SW development ethics (Contd.)	
3	Lec 7 Lec 8	Software processes Software processes (Contd.)	

	Lec 9	Software processes (Contd.)	
4	Lec 10 Lec 11 Lec 12	Agile software development Agile software development (Contd.) Agile software development (Contd.)	Class Test 2
5	Lec 13 Lec 14 Lec 15	Requirements engineering Requirements engineering (Contd.) Requirements engineering (Contd.)	
6	Lec 16 Lec 17 Lec 18	Requirements engineering Requirements engineering (Contd.) Requirements engineering (Contd.)	
7	Lec 19 Lec 20 Lec 21	System modeling System modeling (Contd.) System modeling (Contd.)	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	System modeling System modeling (Contd.) System modeling (Contd.)	
9	Lec 25 Lec 26 Lec 27	Architectural design Architectural design (Contd.) Architectural design (Contd.)	
10	Lec 28 Lec 29 Lec 30	Design and implementation Design and implementation (Contd.) Design and implementation (Contd.)	
11	Lec 31 Lec 32 Lec 33	Software testing Software testing (Contd.) Software testing (Contd.)	Class Test 3
12	Lec 34 Lec 35 Lec 36	Software quality Software quality (Contd.) Software quality (Contd.)	
13	Lec 37 Lec 38 Lec 39	System dependability and reliability engineering System dependability and reliability engineering (Contd.) System dependability and reliability engineering (Contd.)	
14	Lec 40 Lec 41 Lec 42	Introduction to project management Introduction to project management (Contd.) Introduction to project management (Contd.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C4, C6
	Class Performance	5%	-	-
	Class Attendance	5%	-	-

	Mid term	10%	CO2	C4, C6
Final Exam		60%	CO1	C1-C3
			CO3	C4, C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, A = Affective Domain)

REFERENCE BOOKS

1. Software Engineering (10th Edition) by Ian Sommerville
2. Software Engineering – a practitioner‘s Approach (7th Edition) by Roger S. Pressman
3. Software Engineering: Principles and Practice (3rd Edition) by Hans van Vliet

REFERENCE SITE

CSE-320: Software Engineering Sessional

COURSE INFORMATION

Course Code	:	CSE-320	Lecture Contact Hours	: 3.00 hrs in alternative wk
Course Title	:	Software Engineering Sessional	Credit Hours	:0.75

PRE-REQUISITE

Course Code: CSE-319
Course Title: Software Engineering

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Software Engineering Sessional course provides a practical experience on developing innovative solutions for real life problems by applying software engineering fundamentals which involve understanding the applicability of different software process models for different context, performing requirement analysis, designing system architecture as well as system models using unified modeling language, developing prototypes using prototyping tools and evaluating the prototype using test cases.

OBJECTIVE

1. To learn software engineering fundamentals through a practical approach by having experience on developing software systems for solving real-life problems innovatively.
2. To get familiar with documenting software process model, requirement analysis, system architecture, system models formally for a software system.
3. To get oriented with using prototyping tools to develop prototypes for a software system and evaluating those using test cases.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand and apply software development process models.	C2, C3	1-7	1,2,3,4	3	Pr, Viva
CO2	Analyze the user requirements and design the system models.	C2, C4			5,4,7,8	Pr, R, Viva
CO3	Use software prototyping tool and develop system prototypes, and design test cases to evaluate the prototypes.	C5, C6,			4,5,6	PR, R, Viva

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile; PR – Project; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Concepts of software engineering: different phases of software; **Software processes:** software process models, process activities; **Requirements engineering:** functional and non-functional requirements, software requirements document, requirement specification, requirement elicitation and analysis; **System modeling:** context model, interaction models,; **Prototyping tools:** orientation with modern prototyping tools; **Architectural design:** architectural views and patterns; **Design and implementation:** object oriented design, design patterns; **Software testing an prototype evaluation:** development testing, release testing, user testing.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand and apply software development process models	H											
CO2	Analyze the user requirements and design the system models.		H										
CO3	Use software prototyping tool and develop system prototypes and test cases to evaluate the prototypes.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Acquire a strong level of knowledge regarding the applicability of software development process through the fundamental concept of software engineering.
CO2-POb	High,	Analyze and interpret user needs as well as develop system models accordingly for complex computing systems for requirement analysis.
CO3-POc	Medium	Conduct experiments to understand whether the prototypes are able to meet users ‘desired specifications and evaluate those by creating appropriate test cases using modern engineering and IT tools for prototyping.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	21
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lab-1,2	Introducing software development process models and discussion on possible innovative project ideas	
2	Lab-3,4	Project selection and applying software development process models on selected ideas.	
3	Lab-5,6	Conducting the requirements engineering following the information gathering techniques on the selected projects.	
4	Lab-7,8	Designing the system models (context diagram, Use case diagram, Activity Diagram, and Sequence diagram etc.) using unified modeling language for the selected projects [Using Microsoft Visio/Figma/Balsamiq tool]	
5	Lab-9,10	Designing the system architecture and developing prototypes for the selected projects and design implementation [Using Figma/Balsamiq tool]	
6	Lab-11,12	Developing the test cases and evaluating the prototypes	
7	Lab-13,14	Final documentation and project submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Report/ Documentation	25%	CO1	C2, C3
			CO2	C2, C4
			CO3	C5, C6
	Presentation	15%	CO1	C2, C3
			CO2	C2, C4
			CO3	C5, C6
Final Project Assessment, and Viva		60%	CO1	C2, C3
			CO2	C2, C4
			CO3	C5, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Software Engineering (10th Edition) by Ian Sommerville
2. Software Engineering – a practitioner ‘s Approach (7th Edition) by Roger S. Pressman
3. Software Engineering: Principles and Practice (3rd Edition) by Hans van Vliet

REFERENCE SITE

CSE-364: Software Development Project

COURSE INFORMATION

Course Code Course Title	: CSE-364 : Software Development Project	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The Software Development Project course is designed to make its learners able to solve advanced level industry problems and develop real time projects professionally.
OBJECTIVE
1. To give ideas about programming related to software development. 2. To prepare students for the advanced level software development projects of industry. 3. To design real time projects for web or mobile platform. 4. To increase practical knowledge to identify the relative merits of different project designs and programming constructs.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify advanced programming languages and techniques to design real time projects which are complex in nature.	C3-C4, C6, P7	1, 2, 3 , 6, 7	1, 2, 4,5	5	Pr, R, PR
CO2	Develop industry level applications considering changes required in style of developing and maintaining the system.	C3, P6, P7			6	Pr, R, PR
CO3	Illustrate the project management plan and execute accordingly.	C3, A3			-	Pr, R
CO4	Generate effective reports and presentations to carry out the projects by communicating with engineering society.	C3, A3			-	Pr, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Laboratory works based on current industry requirement of advanced level programming language which will include the following: **Project Planning:** Work breakdown structure (WBS) creation, Resource allocation and scheduling, Budgeting and cost estimation, Risk management planning, Stakeholder communication planning; **Task executing** tracking and progress monitoring; **Software Tools for Project Management:** Microsoft Project, Jira, Trello; Unit Testing, Black Box Testing;
SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify advanced programming languages and techniques to design real time projects which are complex in nature.			H									
CO2	Develop industry level applications considering changes					H							

	required in style of developing and maintaining the system.												
CO3	Illustrate the project management plan and execute accordingly.											H	
CO4	Generate effective reports and presentations to carry out the projects by communicating with engineering society.										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1- POc	High	To design solutions and systems for complex engineering problems, one needs to select appropriate programming language for implementing the system and techniques for designing system architecture, front end and back end keeping in mind the aspects of societal effects.
CO2-POe	High	To apply modern engineering and IT tools one needs to know to adapt to the changes in style of developing and maintaining systems.
CO3-POk	High	To implement complex real-time projects, one needs to know how to plan them ahead of time, follow them accordingly, and estimate the budget to make the project deliverable.
CO4- POj	High	It requires one to demonstrate the information gathered with different engineering communities effectively for understanding the impact of the projects and developing it efficiently.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Project Preparations	21
Formal Assessment	
Continuous Assessment	4
Final Examination	3
Total	70

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lab**	**Topics**	**Remarks**
1	Lab 1	Introduction to software development course Group Forming Brainstorming and generating project ideas to include resource planning, allocation and budget management; and due deliberation on risk management and mitigation plans	Presentation
2	Lab 2	Project Proposals presentation and Finalization of the Project	Report and Presentation

		Project Proposals should include strategy of project management planned for successful implementation of the project with special emphasis on resource allocation & management, budget planning & management, risk assessment & management Propose use of appropriate tools for project management.	
3	Lab 3	Utilizing appropriate frameworks for front-end design (e.g., Figma) for the project And making final decisions on frontend frameworks	Presentation
4	Lab 4	Design and implement the frontend of the project	Report and Project Update
5	Lab 5	Controlling versions of the front-end development.	Project Update
6	Lab 6	Debugging and rectifying issues of the front-end development	Project Update
7	Lab 7	Completion of development of Front End	Project Update
8	Lab 8	Design back end of the project	Report
9	Lab 9	Implement back end of the project	Project Update
10	Lab 10	Completion of the back end of the project	Project Update
11	Lab 11	Integration of Backend and Frontend and Deployment of the Application. Use of appropriate tools for debugging and testing.	Project Update and Report
12	Lab 12	Integration of Backend and Frontend and Deployment of the Application.	Project Update
13	Lab 13	Final presentation on the project	Presentation, Project
14	Lab 14	Final report and project submission	Report and Project

ASSESSMENT STRATEGY

<table>
<tr><th colspan="3">Components</th><th>Grading</th><th>COs</th><th>Blooms Taxonomy</th></tr>
<tr><td rowspan="5">Continuous Assessment (100%)</td><td colspan="2">Class Performance & Observation</td><td>10%</td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">Project</td><td>Project Proposal (10%)</td><td rowspan="3">70%</td><td rowspan="4">CO1
CO2
CO3
CO4</td><td rowspan="4">C3-C4, C6, A3, P6, P7</td></tr>
<tr><td>Project Update (30%)</td></tr>
<tr><td>Project Final Submission (30%)</td></tr>
<tr><td colspan="2">Report</td><td>20%</td></tr>
<tr><td colspan="3">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Learning Web App Development: Build Quickly with Proven JavaScript Techniques - by Semmy Purewal
2. Go Web Programming – by Chang Sau Sheong

CSE-350: Industrial Training

COURSE INFORMATION			
Course Code Course Title	: CSE 350 : Industrial Training	Lecture Contact Hours Credit Hours	: 4 Weeks : 1.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course has been designed for the students to have real life experiences to help them prepare for their career.

OBJECTIVE

1. To expose student to work responsibility and ethics in working environment.
2. To develop communication skill effectively within the working environment.
3. To apply theoretical and academic knowledge for solving the industrial problem.
4. To acquire the knowledge on preparation of training reports and presentations.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop work responsibility and ethics in the working environment.	P2	1-7	1,3,4, 5	7	Pr, R
CO2	Propose solutions to real-world problems considering societal, health, safety, legal and cultural issues based on experiences gained during the training.	C3, P1			7	Pr, R
CO3	Effectively communicate with the engineering community on engineering activities within the working environment through preparing related documentation.	P6			-	Pr, R
CO4	Apply theoretical and academic knowledge for solving the industrial problem.	C3, P4			5	Pr, R
CO5	Develop the skill to work effectively as a team member and contribute individually towards achieving the objective of the team.	P4			5	Pr, R
CO6	Develop an understanding of complex engineering problems by analyzing varied scenarios in context to societal and environmental issues and prepare a recommended solution thereof.	P4			5	Pr, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

As designed by the respective industry

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop work responsibility and ethics in the working environment.								H				
CO2	Propose solutions to real-world problems considering societal, health, safety, legal and cultural issues based on experiences gained during the training.						H						
CO3	Effectively communicate with the engineering community on engineering activities within the working environment through preparing related documentation.										H		
CO4	Apply theoretical and academic knowledge for solving the industrial problem.												H
CO5	Develop the skill to work effectively as a team member and contribute individually towards achieving the objective of the team.									H			
CO6	Develop an understanding of complex engineering problems by analyzing varied scenarios in context to societal and environmental issues and prepare a recommended solution thereof.							H					

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO8	High	It requires to develop ethics in working environment with the help of understanding and level of practice
CO2-PO6	High	It requires to infer contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities
CO3-PO10	High	It requires communicating effectively within the working environment according to the type of activities performed.
CO4-PO12	High	Applying theoretical and academic knowledge for solving the industrial problem enhances the depth of continuing learning ahead.
CO5-PO9	High	It requires teamwork to represent the objectives of any given project.
CO6-PO7	High	It requires to know the complex situation of any project for societal and environmental issues.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	24
Student-Centred Learning	-

Self-Directed Learning Non-face-to-face learning Revision Assignment Preparations	 - - 6
Formal Assessment Continuous Assessment Quiz/ test Mid-Term Final Examination	 24 - - -
Total	54

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topics	Assessment Methods
1	As per industrial plan	Presentation And Report
2	As per industrial plan	
3	As per industrial plan	
4	As per industrial plan	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment	80%	CO1, CO2, CO3, CO4, CO5, CO6	P1, P2, P4, P6, C3
Report	20%		
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

REFERENCE SITE

GERM-352: Fundamentals of Research Methodology

COURSE INFORMATION			
Course Code Course Title	: GERM-352 : Fundamentals of Research Methodology	Contact Hours Credit Hours	3.00 1.50

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Fundamentals of Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in Science and Engineering context. UG students would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, time management, report writing, and presentation. Once equipped with this knowledge, participants would be well-placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.

OBJECTIVE

The primary objective of this course is to develop a research orientation among the UG students and to acquaint them with fundamentals of research methods. Some other objectives of the course are:

1. To evaluate/review related extant literature, form a variety of sources, pertinent to the research objectives/questions.
2. To expose students to various research methodologies (design), relevant to the research problem needing to be addressed.
3. To explain and justify how researchers will collect and analyse research data.
4. To educate students in the common mistakes, research misconduct, and ethical considerations in the field of research methodology.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the research fundamentals and formulate problem statements and research questions/objectives.	C2	-			Assignment/ Quiz
CO2	Formulate and compose a research proposal considering research activities/design, background studies	C3	-			Report/ Presentation/ Assignment/ Quiz
CO3	Demonstrate ethical considerations in all aspects of research work and methodology	C3	-			Report/Presentation/ Assignment
CO4	Understanding financial implication and implementation issues related to application of the research outcome	C2	-			Report/Presentation/ Assignment

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Foundations of Research: Meaning of Research, Definitions of Research, Objectives of Research, Motivation in Research, General Characteristics of Research, Criteria of Good Research, Types of Research, Concept of theory, empiricism, deductive and inductive theory, Characteristics of scientific method. **Problem Identification and Formulation**: Meaning and need of Review of Literature, How to Conduct the Review of literature, Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance. **Research Design**: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. **Experimental/Computational Design:** Concept of Independent & Dependent variables. **Data Analysis**: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. **Research Misconduct and Ethics:** Understand the research misconduct, type of research misconduct, Ethical issues in conducting research, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. **Use of Tools / Techniques for Research:** Layout of a Research Paper, Methods to search required information effectively, Reference Management Software like Zotero/ Mendeley, Software for paper formatting like LaTeX/ MS Office, Software for detection of Plagiarism. Time management and developing Gantt Charts.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the research fundamentals and formulate problem statements and research questions/objectives.	H											
CO2	Formulate and compose a Research proposal considering research activities, background studies, and following standard guidelines.		H										
CO3	Demonstrate ethical considerations in all aspects of research work and methodology								H				
CO4	Understanding financial implication and implementation issues related to application of the research outcome.											~~M~~	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Increase breadth & depth of knowledge through understanding the research fundamentals and formulating research objectives.
CO2-POb	Low	Understand complex problems by doing background studies and following standard guidelines.
CO3-POh	High	Exercise ethical practice while conducting research and writing reports.
CO4-POk	Medium	Understand the level of management required for a Research proposal considering research activities.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	56
Student-Centred Learning	-
Self-Directed Learning	

Non-face-to-face learning Revision Assessment Preparations	- - -
Formal Assessment Continuous Assessment Final Examination	- 4 4
Total	64

TEACHING METHODOLOGY

Lecture and Discussion, Mini-Seminars by Experts, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1	Foundations of Research: Meaning of Research; Definitions of Research; Objectives of Research; Motivation in Research; General Characteristics of Research; Criteria of Good Research; Types of Research; Concept of theory, empiricism, deductive and inductive theory; Characteristics of scientific method.	**Continuous Assessment** (presentation/ quiz/other assignment)
2	Lec 2	Practice session on Foundations of Research	
3	Lec 3	Problem Identification & Formulation: Meaning & need of Review of Literature; How to Conduct the Review of literature; Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.	
4	Lec 4	Practice session on Problem Identification & Formulation	**Assignment 1** Assignment has to provide before, here students will submit report and give PPT
5	Lec 5	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.	
6	Lec 6	Practice session on Research Design	
7	Lec 7	Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	
8	Lec 8	Practice session on Data Analysis	**Continuous Assessment** (presentation/ quiz/other assignment)
9	Lec 9	Research Misconduct and Ethics: Understand the research misconduct; type of research misconduct; Ethical issues in conducting research; Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	
10	Lec 10	Practice session on Research misconduct and Ethics	
11	Lec 11	Use of Tools / Techniques for Research: Layout of a Research Paper; Methods to search required information effectively; Reference Management Software like Zotero/Mendeley; Software for paper formatting like LaTeX/MS Office; Software for detection of Plagiarism. Time management and developing Gantt Charts.	**Assignment 2** Assignment has to provide before, here students will submit report and give PPT
12	Lec 12	Practice session on Use of tools / techniques for Research	
13	Lec 13	Review Session (Theory) – I /Final Presentation	

14	Lec 14	Review Session (Practice) – II /Final Presentation	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Continuous Assessment	30%	CO1 and CO3	C2-C3
Assignment I	20%	CO1 and CO3	C2-C3
Assignment II	50%	CO2 and CO3	C2-C3
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Engineering Research Methodology: A Practical Insight for Researchers. Springer, by Deb, Dipankar, Dey, Rajeeb, Balas, Valentina E.
2. Research Methods for Engineers, 1st Edition, by David V. Thiel.
3. Handbook of Research Methodology by Talati, J.K.
4. Introducing Research Methodology: A Beginner′s Guide to Doing a Research Project by Uwe Flick
5. DRM, a Design Research Methodology by Lucienne T.M. Blessing and Amaresh Chakrabarti
6. Research Methods: Information, Systems, and Contexts by Kirsty Williamson, Graeme Johanson
7. Zelkowitz, M. V. and Wallace, D. R. (1998), Experimental models for validating technology, *Computer*, vol. 31, no. 5, pp. 23-31.
8. Internet, mail, and mixed-mode surveys: the tailored design method (3rd ed.) by Dillman, D. A., Smyth, J. D., & Christian, L. M.
9. Improving survey questions: design and evaluation. Sage Publications, by Fowler, F. J.
10. Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, by Cohen, J., Cohen, P., West, S., & Aiken, L.
11. Experimental and Quasi-Experimental Design for Generalized Causal Inference. Boston, Mass: Houghton Mifflin, by Shadish W.R., Cook T.D. & Campbell P.T.
12. Computational handbook of statistics (4th ed.). New York: Longman, by Bruning, J. L. & Kintz, B. L.

REFERENCE SITE

GES-301: Fundamentals of Sociology

COURSE INFORMATION

Course Code Course Title	: GES -301 : Fundamentals of Sociology	Lecture Contact Hours Credit Hours	2.00 2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course has been designed to understand the human inter-personal relationship and human psychology in the society and to apply this knowledge in the practical field as an engineer through the study of varied societies and cultures.

OBJECTIVE
1. To learn basics, scopes and perspectives of sociology. 2. To understand societal and cultural issues in national, global and environmental context. 3. To synthesis between social problem and social satisfaction in real life.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the basic nature, scope and perspective of sociology and the criteria of social research process andb methodologies	C1		-	1	T, ASG, F
CO2	Apply contextual knowledge to assess societal and cultural issues in national and global context and also environmental context for sustainable development.	C2		-	1	Q, F
CO3	Analyze social problem, social stratifications, socialism, capitalism and economic life and political issues	C2		-	2	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Understanding Society: Nature and scope Sociological imagination, Perspectives of sociology, Stages of social research and research method; **Social Phenomena:** Culture and civilization, Socialization and self -development, Globalization and social changes, Media and individual, Social organizations and social problems, social stratification, industrial revolution, Capitalism and socialism, Work and economic life, Environment and human activities; **Social Change:** Climate change and global risk, Population and human society, Urbanization and city development, Social changes and technology;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the basic nature, scope and perspective of sociology and the criteria of social research process and methodologies										H		
CO2	Apply contextual knowledge to assess societal and cultural issues in national and global context and also environmental context for sustainable development.						M						
CO3	Analyze social problem, social stratifications, socialism, capitalism and economic life and political issues						H				M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POj	High	In order to understand the basic nature, scope and perspective of sociology and the criteria of social research process and methodologies, it is required to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
CO2-POf	Medium	In order to apply contextual knowledge to assess societal and cultural issues in national and global context and also environmental context for sustainable

		development, application of reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems is required.
CO3-POf	High	In order to analyze Social problem, social stratifications, socialism, capitalism and economic life and political issues, application of reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems is required
CO3-POj	Medium	In order to analyze Social problem, social stratifications, socialism, capitalism and economic life and political issues, it is required to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28
Revision	14
Assessment Preparations	14
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lectures	Lecture/Tutorial/Assignment Topic	Assessment Method
1	Lec-1	Definition, nature and scope of sociology	Class test-1
	Lec-2	Sociological imagination	
2	Lec-3	Perspectives of sociology	
	Lec-4	Orientation of sociological theories	
3	Lec-5	Social research and its process	
	Lec-6	Research designs and techniques.	
4	Lec-7	Introducing culture and its variations	
	Lec-8	civilization	
5	Lec-9	Defining family and its changes	
	Lec-10	Socialization process and development of self	
6	Lec-11	Introducing globalization and its impact on human life	Midterm Exam
	Lec-12	Factors responsible to globalization	
7	Lec-13	Media and its impact in modern society	
	Lec-14	Addressing social problems of Bangladesh	
8	Lec-15	Introducing social groups and organizations	
	Lec-16	Introducing bureaucracy and good governance	
9	Lec-17	Introducing social stratifications and social inequality	
	Lec-18	Poverty and its types and dimensions	
10	Lec-19	Industrial revolution and aftermath	
	Lec-20	Urbanization and city development	
11	Lec-21	Capitalism: features and influence	

	Lec-22	Socialism: features and influence	Class test-2
12	Lec-23	Environment and human activities	
	Lec-24	Climate change and global risk	
13	Lec-25	Population of Bangladesh: problem or prospect	
	Lec-26	Crime and deviance: a brief analysis	
14	Lec-27	Review 1	
	Lec-28	Review 2	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment	20%	CO1	C1
	Class Attendance	5%	-	-
	Class Performance	5%	CO2	C2
	Mid term	10%	CO3	C2
Final Examination		60%	CO1-CO3	C2-C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Brinkerhoff, David B., Suzanne T. Ortega, and Rose Weitz. Essentials of sociology. Cengage Learning, 2013.
2. Rao, CN Shankar. “Sociology: Primary Principles.” New Delhi: S. Chand and Company Ltd (2002).
3. Giddens, Anthony, ed. Human societies: an introductory reader in sociology. Cambridge, Eng.: Polity Press, 1992.

GESL-303: Environment, Sustainability and Law

COURSE INFORMATION

Course Code	: GESL-303	Lecture Contact Hours	2.00
Course Title	: Environment, Sustainability and Law	Credit Hours	2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to provide a basic idea about environmental systems, impact of technology on environment and environmental sustainability and also familiar students with elementary knowledge of laws related to environment.

OBJECTIVE

1. To develop a better understanding of human perception and policies towards the environment.

2. To recognize and analyse different environmental problems and focus on design for sustainable development and technology for improving environmental quality.
3. To have a sound knowledge on environmental law.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop better understanding of environmental systems and impact of technology on the environment	C1-C2	1,4, EP 1	1,2,4	1	T, F
CO2	Analyse different environmental problems and apply technologies for a sustainable environment.	C3-C4			7	T, MT, F, ASG
CO3	Understand the laws related to environment and sustainability and apply those laws whenever required.	C2-C3			7	T, MT, F
CO4	Develop communication skills by presenting topics on computer graphics.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Environment and its components, Biodiversity at global, national and local levels; **Social Issues and Environment:** Problems relating to urban environment- Population pressure, water scarcity, industrialization; land use & degradation, climate change; **Impact of Technology on the Environment:** how digital technology impacts upon the environment, Toxic Techno-trash; Efficient and eco-friendly use of technology.

Environmental Sustainability: Principles of Environmental Sustainability, Importance of sustainable practices; **Technologies for environment:** Environmental Biotechnology-Biological indicators, bio-sensors; **Green Computing:** Green Technologies and Environmental Sustainability, Technologies for reducing greenhouse gases and for biofuel production; Recycling techno-trash, E-waste management; Models and Frameworks for Sustainability; **IT for Sustainable Environment:** Natural resource protection and environmental enhancement using IT; Use and impact of IT within communities, IT and sustainability development

Environmental Law: Nature and Origin of International Environmental Organizations (IEOs), Common-Law Approaches to Environmental Problems, Impact of environmental laws in solving environmental problems, Environmental legislation and its importance, Environmental ethics and social responsibility, Importance of sustainability assessment tools and institutions before and after laws are adopted.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop better understanding of environmental systems and impact of technology on the environment	H											
CO2	Analyse different environmental problems and apply technologies for a sustainable environment.						H	H					
CO3	Understand the laws related to environment and sustainability and apply those laws whenever required.						M		H				
CO4	Develop communication skills by presenting topics on computer graphics.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POa	High	Understand various environmental issues and determine appropriate solutions applicable for solving the problems.
CO2-POf	High	Develop eco-friendly technological solutions for enhancing environmental sustainability and explain the impacts of those on the environment.
CO2-POg	High	Develop a strong sense of responsibility to protect the degrading environment and apply knowledge of green technologies for a sustainable environment.
CO3-POf	Medium	Apply the existing environmental laws where and whenever needed.
CO3-POh	High	Develop the understanding of implementing the laws within family, society, country and globally.
CO4-POj	Low	Develop communication skills through participating in presentations.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	28
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 28 14 14
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2	Environment and its components, Biodiversity at global, national and local levels	Class Test 1
2	Lec 3 Lec 4	Problems relating to urban environment- Population pressure, water scarcity, industrialization; land use & degradation, climate change	
3	Lec 5 Lec 6	How digital technology impacts upon the environment	
4	Lec 7 Lec 8	Toxic Techno-trash; Efficient and eco-friendly use of technology	
5	Lec 9 Lec 10	Principles of Environmental Sustainability, Importance of sustainable practices	
6	Lec 11 Lec 12	Environmental Biotechnology Biological indicators, bio-sensors	Mid Term Exam
7	Lec 13 Lec 14	Green Technologies and Environmental Sustainability, Technologies for reducing	

		greenhouse gases and for biofuel production	
8	Lec 15 Lec 16	Recycling techno-trash, E-waste management,	
9	Lec 17 Lec 18	Models and Frameworks for Sustainability, Natural resource protection and environmental enhancement using IT	
10	Lec 19 Lec 20	Use and impact of IT within communities, IT and sustainability development	
11	Lec 21 Lec 22	Nature and Origin of International Environmental Organizations (IEOs), Common-Law Approaches to Environmental Problems,	Class Test 2
12	Lec 23 Lec 24	Impact of environmental laws in solving environmental problems, Environmental legislation and its importance	
13	Lec 25 Lec 26	Environmental ethics and social responsibility, Importance of sustainability assessment tools and institutions before and after laws are adopted.	
14	Lec 27 Lec 28	Importance of sustainability assessment tools and institutions before and after laws are adopted.	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C2
			CO2	C3-C4
			CO3	C2-C3
	Class Attendance	5%	-	-
	Class Performance	5%	CO4	A2
	Mid term	10%	CO2	C3-C4
			CO3	C2-C3
Final Exam		60%	CO1	C1-C2
			CO2	C3-C4
			CO3	C2-C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Environmental Technology and Sustainability: Physical, Chemical and Biological Technologies for Clean Environmental Management (1st)- Basanta Kumara Behera (Author), Ram Prasad (Author)
2. Environmental Studies (2nd)- Dr. B. S. Chauhan
3. A Textbook of Environmental Studies (Revised) D K Asthana & Meera Asthana
4. Understanding environmental law (3rd) Philip Weinberg

REFERENCE SITE

LEVEL-4 SPRING TERM

CSE-405: Computer Interfacing

COURSE INFORMATION			
Course Code Course Title	: CSE 405 : Computer Interfacing	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: CSE-305 Microprocessors
Course Title: Micro-controllers and Assembly Language

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course introduces basic concepts and techniques used in interfacing a processor to other external devices and components. Its aim is to give sufficient knowledge of designing and working principle of interfacing different computer hardware components and apply this knowledge in the real-world applications.

OBJECTIVE

1. To enable the students 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 systems incorporating input/output to and from external devices.

LEARNING OUTCOMES& GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Classify, identify and analyze that how to interface different types of external components and communicate with them (Peripherals, sensors, PPIs, PICs etc.) with computer system	C1-C3, P4	1,3,7	2	3	T, MT, F
CO2	Apply and implement the external components in real life application and improve the results based on statistical analysis	C3-C4, A2			5	T, MT, F
CO3	Analyze and evaluate abstract problems and apply hardware and software components to address the problems.	C5-C6, P5			2, 6	T, MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Basics of peripherals and interfacing, General purpose peripherals and special purpose peripherals, Serial and parallel communication interface: Review of I/O techniques---Simple I/O, Strobed I/O, Handshake I/O, DMA controlled I/O;
I/O devices, Interfacing with different peripheral devices --- Keyboard, Alphanumeric Display, --- 7-segment display, LCD display, touchscreen, LEDs, Interfacing Microcomputers ports to high power devices, Interfacing to AC power devices, Interfacing microcomputer to motor specially to stepper motors, controlling semiconductor power switches e.g., BJT, MOSFET, SCR and Triac, Application of Opto-coupler and relays --- analog and SSD Relays.
Embedded Systems, Different types Sensors and Transducers and its applications, Interface to A/D and D/A converters, Microcomputer based industrial process control system, DMA controller, Printer Interface, Disk and Tape Storage, Barcode Reader, USB interface, Sound Card, MIDI interface, serial communication interface

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Classify, identify and analyze that how to interface different types of external components and communicate with them (Peripherals, sensors, PPIs, PICs etc.) with computer system	H											
CO2	Apply and implement the external components in real life application and improve the results based on statistical analysis			H									
CO3	Analyze and evaluate abstract problems and apply hardware and software components to address the problems.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	H	In order to describe how to interface different types of external components with computer system to user requirements, one need the knowledge of computer interfacing
CO2-POc	H	To apply external components in real life application and improve the results based on statistical analysis one has to design the systems.
CO3-POb	H	Analyze and evaluate abstract problems and apply hardware and software components to address the problem one need to analyze the fundamental principles, typical characteristics and mechanisms of required micro-controller tools, hardware and software.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	**Mid Term**
9	Lec 25 Lec 26 Lec 27	Block Data Transfer, DMA, Parallel Interface, SCSI, Serial Interface-Synchronous and Asynchronous Transmission	
10	Lec 28 Lec 29 Lec 30	DMA Controller 8257, RS232, null modem connection, line drivers, Single-ended Transmission, balanced transmission, differential receiver	
11	Lec 31 Lec 32 Lec 33	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 3**
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	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3, P4
			CO2	C3-C4, A2
			CO3	C5-C6, P5
	Class Performance	5%	CO1	C1-C3, P4
			CO2	C3-C4, A2
	Class Attendance	5%	-	-
	Mid term	10%	CO2	C3-C4, A2
			CO3	C5-C6, P5
Final Exam		60%	CO1	C1-C3, P4
			CO2	C3-C4, A2

		CO3	C5-C6, P5
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)
REFERENCE SITE

CSE-406: Computer Interfacing Sessional

COURSE INFORMATION				
Course Code	:	CSE 406	Lecture Contact Hours	: 3.00 hrs in alternative wk
Course Title	:	Computer Interfacing Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: CSE 405 Course Title: Computer Interfacing
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Culminating demonstration of skills and knowledge achieved to date to apply and solve real life IT dependent problems using micro-controller, external devices and related required software.
OBJECTIVE
This course is designed to introduce the basic concepts and techniques for interfacing a micro-controller to external devices for data collection and process control and developing the related software required.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Analyze and compare design alternatives, at the system and subsystem levels	C2-C4, P1	1,2, 3,4, 7	1,2,3 4,5	8	R, PR, Pr
CO2	Plan and organize an engineering design project to develop a schedule including milestones, and estimate effort and costs incorporating the ethical, financial and environmental issues.	C3, C6, A4			7	R, Pr, PR, V
CO3	Develop full-functional prototype by giving solution of a real-world problem	C4-C6, P4			5,6,7	PR, Pr, R, V

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, R-Report, Pr - Presentation, T-Test (Online), PR-Project, V-Viva)

COURSE CONTENT
Implementation: Concept development, prototype enhancement, complete implementation, feedback and improvement, result analysis and performance evaluation, report writing, paper submission, presentation and final evaluation.
SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Analyze and compare design alternatives, at the system and subsystem levels				H								
CO2	Plan and organize an engineering design project to develop a schedule including milestones, and estimate effort and costs incorporating the ethical, financial and environmental issues.						H						
CO3	Develop full-functional prototype by giving solution of a real-world problem											H	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1 – POd	High	To analyze design alternatives and to conduct investigations using research-based knowledge and methodologies for valid conclusions.
CO2 – POf	High	To estimate the effort and costs of the project one needs to incorporate the society's ethical, financial and environmental issues.
CO3 –POk	High	In order to develop the successful prototype its mandatory to manage the project and maintain the financial aspects.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	21
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	47

TEACHING METHODOLOGY

Lectures, class performances, assignments, rubrics on problem analysis, literature review and designing prototype.

COURSE SCHEDULE

Week	**Lecture**	**Topics**
1	Lab 1	Project Proposal, Total Project Plan, Project Selection
2	Lab 2	Requirement Analysis, Scheduling, Orientation with System Requirements
3	Lab 3	Project Update
4	Lab 4	Project Update
5	Lab 5	Project Update
6	Lab 6	Full Functional Prototype V.1 Submission

7	Lab 7	Full Functional Prototype Final Submission and Final Report Submission

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Report (30%)	Idea Submission	10%	CO1	C2-C4, P1
	Project Plan/ Scheduling	10%	CO2	C3, C6, A4
	Final Article	10%	CO3	C4-C6, P4
Project (40%)	Project Update	20%	CO2	C3, C6, A4
	Functional Prototype	20%	CO3	C4-C6, P4
Viva (20%)	Viva	20%	CO2	C3, C6, A4
			CO3	C4-C6, P4
Class Observation (10%)		10%	-	-
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)
4. Software Engineering - Ian Sommerville
5. Android Programming: The Big Nerd Ranch Guide (3rd Edition) (Big Nerd Ranch Guides) 3rd Edition
6. Data and Computer Communication - William Stallings
7. Professional Android, Reto Meier, Ian Lake; 4th Edition

REFERENCE SITE

CSE-415: Human Computer Interaction

COURSE INFORMATION

Course Code Course Title	: CSE 415 : Human Computer Interaction	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The Human Computer Interaction course covers the foundations of Human Computer Interaction (HCI), a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.

OBJECTIVE

1. To understand the definitions and foundations of the HCI domain.
2. To design interfaces and interactive solutions using user-centered techniques.
3. To apply evaluation methods, quality factors, and data analysis techniques.

4. To explore research frontiers of HCI, including universal design, responsive design and pervasive computing.

LEARNING OUTCOMES& GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand and applying the fundamentals of HCI and Interaction design.	C1- C3	1,2,3	-	3	T, F
CO2	Analyse focused users and system to identify user needs and system constraints to inform the design process.	C4			3, 4	MT, F
CO3	Design and evaluate the user interfaces as well as interactive systems for building intuitive usable software solutions.	C4, C5			4, 5	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to HCI and Interaction design: HCI, Interaction design, The process of design, User focus, Scenarios, Navigation design, Screen design and layout, Iteration and prototyping. **HCI in the software process:** The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale. **Design rules:** Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns. **Evaluation techniques:** What is evaluation? What, why, and when to evaluate, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Evaluation paradigms and techniques, The D E C I D E framework to guide evaluation. **Observing users**: Participant observation, ethnography, Data collection, and Analyzing, interpreting and presenting data, Qualitative analysis, Feeding the findings back into design. **Asking users and experts**: Interviews, Questionnaires, Inspections, walkthroughs. **Universal design:** Universal design principles, multi-modal interaction, designing for diversity. **Task analysis:** Differences between task analysis and other techniques, Task decomposition, Knowledge-based techniques, Entity-relationship-based techniques, Sources of information and data collection, Uses of task analysis. **Modeling rich interaction:** Status-event analysis, Rich contexts, Low intention and sensor-based interaction. **Ubiquitous computing and augmented realities:** Ubiquitous computing applications research, virtual and augmented reality, Information and data visualization. **Hypertext, multimedia and the world wide web:** Understanding hypertext, Finding things, Web technology and issues, Static web content, Dynamic web content.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand and applying the fundamentals of HCI and Interaction design.	H											
CO2	Analyse focused users and system to identify user needs and system constraints to inform the design process.		H										
CO3	Design and evaluate the user interfaces as well as interactive systems for building intuitive usable software solutions.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POa	High	Acquire a good level of knowledge regarding HCI, especially on interaction design and evaluation through the fundamental concept of HCI like interaction design, design process, design principles, universal design, rich interaction, etc.
CO2-POb	High	Analyzing focused users and system requirements involves breaking down complex problems into manageable components. By identifying user needs and system constraints, students engage in problem analysis, a fundamental aspect of engineering practice.
CO3-POc	High	Understand the interaction design techniques, rules, and principles for design the software systems, as well as acquire the skills for pursuing in-depth design (or usability) evaluation to (re)design any information system in order to assure the enhanced usability and user-experience by having a good level of familiarity with different evaluation methodologies.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to HCI and Interaction design: HCI, Interaction design, The process of design User focus, Scenarios, Navigation design Screen design and layout, Iteration and prototyping.	Class Test 1
2	Lec 4 Lec 5 Lec 6	HCI in the software process: The software life cycle, Usability engineering Iterative design and prototyping, Design rationale.	
3	Lec 7 Lec 8 Lec 9	Design rules: Principles to support usability, Standards Guidelines, Golden rules and heuristics HCI patterns	

4	Lec 10 Lec 11 Lec 12	Evaluation techniques: What is evaluation? What, why, and when to evaluate, Goals of evaluation Evaluation through expert analysis Evaluation through user participation, Choosing an evaluation method.	Class Test 2
5	Lec 13 Lec 14 Lec 15	Evaluation paradigms and techniques, The D E C I D E framework to guide evaluation. The D E C I D E framework to guide evaluation. (Contd.)	
6	Lec 16 Lec 17 Lec 18	Observing users: Participant observation, ethnography, Data collection Analyzing, interpreting and presenting data Qualitative analysis, Feeding the findings back into design	
7	Lec 19 Lec 20 Lec 21	Asking users and experts: Interviews Asking users and experts: Questionnaires, Asking users and experts: Inspections	Mid Term
8	Lec 22 Lec 23 Lec 24	Asking users and experts: Inspections (Contd.) Asking users and experts: walkthroughs. Asking users and experts: walkthroughs (Contd.)	
9	Lec 25 Lec 26 Lec 27	Universal design: Universal design principles Multi-modal interaction Designing for diversity	
10	Lec 28 Lec 29 Lec 30	Task analysis: Differences between task analysis and other techniques, Task decomposition Knowledge-based techniques, Entity-relationship-based techniques Sources of information and data collection, Uses of task analysis.	
11	Lec 31 Lec 32 Lec 33	Modeling rich interaction: Status-event analysis, Rich contexts Low intention and sensor Low intention and sensor (Contd.)	Class Test 3
12	Lec 34 Lec 35 Lec 36	Ubiquitous computing and augmented realities: Ubiquitous computing applications research. virtual and augmented reality Information and data visualization	
13	Lec 37 Lec 38 Lec 39	Hypertext, multimedia and the world wide web: Understanding hypertext, Understanding hypertext (Contd.) Finding things	
14	Lec 40 Lec 41 Lec 42	Web technology and issues Static web content Dynamic web content	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C4, C6
	Class Performance	5%	CO4	A2
	Class Attendance	5%	-	-
	Mid term	10%	CO2	C4, C6
Final Exam		60%	CO1	C1-C3
			CO3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)
REFERENCE BOOKS
1. Julie A. Jacko (Ed.). (2012). Human-Computer Interaction Handbook (3rd Edition). CRC Press. IS 4398-2943-8 2. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale (2003): Human–Computer Interactio Edition. Prentice Hall, 2003. http://hcibook.com/e3/ ISBN 0-13- 046109-1 3. Yvonne Rogers, Helen Sharp, Jenny Preece (2019): Interaction Design: Beyond Human Compute Interaction (5th Edition), John Wiley & Sons. 4. Schneiderman B. and Plaisant, C.: Designing the User Interface (5th Edition), Addison-Wesley. Jo Lazar, Jinjuan Heidi Feng, & Harry Hochheiser Research Methods in Human-Computer Interaction 2010. ISBN 0-470-72337-8, 978-0-470-72337-1
REFERENCE SITE

CSE-416: Human Computer Interaction Sessional

COURSE INFORMATION				
Course Code	:	CSE 416	Lecture Contact Hours	: 3.00
Course Title	:	Human Computer Interaction Sessional	Credit Hours	: 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Motivates to enrich the socio-technological discipline by harnessing the power of computers and communication systems, making them accessible and useful in various aspects of our lives, including work, learning, communication, and recreation.
OBJECTIVE
1. To specify human, societal and computational abilities and constraints to understand the design requirements for developing interactive system. 2. To design and evaluate the quality of a user interface using various methods to design a usable and useful interactive system
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Evaluate an interactive system through HCI principles/guidelines/methods to measure its usability and user experience (UX)	C4	1, 2, 3 4, 6	1, 2, 3,4	8	Pr, PR, R
CO2	Design and develop a prototypical system to enhance the system usability and UX	C4, C5			5	Pr, PR, R

CO3	Assess the user needs and societal impact of the designed system considering the societal knowledge	C3, C4			7	Pr, R

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to Human-Computer Interaction, Task-centered system design, Usability evaluation methods, Empirical study for requirement elicitation and data analysis, Design concepts and principles, design concepts, Prototype, Prototypical tool

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Evaluate an interactive system through HCI principles/guidelines/methods to measure its usability and user experience (UX)				H								
CO2	Design and develop a prototypical system to enhance the system usability and UX			H									
CO3	Assess the user needs and societal impact of the designed system considering the societal knowledge						H						

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POd	High	It requires to investigate the assigned problem by researching on the HCI design principles and evaluate the system's usability and UX through revealed principle to reach a solid conclusion.
CO2-POc	High	It requires to design the solutions meeting specified needs with appropriate consideration for public safety, cultural, societal and environmental consideration s for getting the enhanced usability and UX.
CO3-POf	High	To assess user needs and societal impact of the designed system, it requires gathering contextual knowledge and consequent responsibilities.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	 - - -
Formal Assessment	

Continuous Assessment	02
Final Examination	03
Total	26

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lecture	Topics
1	Lab 1-2	Introduction with HCI labs Design principles
2	Lab 3-4	Introduction with HCI labs Design principles
3	Lab 5-6	Project Idea Approval
4	Lab 7-8	Prototype Practical Session on Card Sorting Project Update 1
5	Lab 9-10	IDM Hands on practice on IDM
6	Lab 11-12	Prototyping Project Update 2
7	Lab 13-14	Design and Development using IDM

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Assessment	30%	CO1, CO2, CO3	C3, C4, C5
	Viva/ Presentation	10%		
Final Project Assessment		50%		
Final Report		10%		
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale (2003): Human–Computer Interaction. 3rd Edition. Prentice Hall, 2003. http://hcibook.com/e3/ ISBN 0-13- 046109-1
2. 2. Interaction Design: Beyond Human-Computer Interaction" by Jennifer Preece, Yvonne Rogers, and Helen Sharp

REFERENCE SITE

CSE-403: Artificial Intelligence

COURSE INFORMATION

Course Code	:	Artificial Intelligence	Lecture Contact Hours	: 3.00
Course Title	:	CSE 403	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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.

LEARNING OUTCOMES & GENERIC SKILLS

<table>
<tr><th>No.</th><th>Course Learning Outcome
(Upon completion of the course, the students will be able to)</th><th>Bloom's Taxonomy</th><th>CP</th><th>CA</th><th>KP</th><th>Assessment Methods</th></tr>
<tr><td>CO1</td><td>Remembering and understanding the notions of rational behavior, goals, subareas, achievements and difficulties of AI agents.</td><td>C1, C2</td><td rowspan="4">1
3
2,
7</td><td rowspan="4">1</td><td>1</td><td>T</td></tr>
<tr><td>CO2</td><td>Able to apply problem solving methods (informed, uninformed, local search, adversarial search and CSP) of single or multi agents to solve real life problems.</td><td>C2, C6</td><td>5,
6</td><td>MT, F</td></tr>
<tr><td>CO3</td><td>Able to apply major concepts and approaches of knowledge representation, planning and learning for improving machine intelligence.</td><td>C6, P3</td><td>5,
8</td><td>MT, F</td></tr>
<tr><td>CO4</td><td>Able to develop the communication skill by presenting topics on Artificial Intelligent.</td><td>A2</td><td></td><td>Pr</td></tr>
</table>

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Overview of AI and intelligent agents; **Problem Solving:** Review of Uninformed Search Strategies and game playing; Informed search Strategies: A*, Heuristic functions, Memory Bounded Search (IDA*, SMA*), Iterative improvement Search, adversarial search, local search Constraint satisfaction problems; **Knowledge representation:** Review of Propositional logic, first order Logic, **Planning:** Introduction to Planning, Partial Order Planning; **Reasoning:** Bayesian Rule and its use in probabilistic reasoning; **Learning:** Belief Networks and Decision Networks; Learning Decision Trees; Learning General Logical descriptions-Hypothesis. Introduction to Natural Language Processing.

SKILL MAPPING

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Course Learning Outcome</th><th colspan="12">PROGRAM OUTCOMES (PO)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th><th>h</th><th>i</th><th>j</th><th>k</th><th>l</th></tr>
<tr><td>CO1</td><td>Remembering and understanding the notions of rational behavior, goals, subareas, achievements and difficulties of AI agents.</td><td>H</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td>Able to apply problem solving methods (informed, uninformed, local search, adversarial search and CSP) of single</td><td></td><td>H</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

	or multi agents to solve real life problems.												
CO3	Able to apply major concepts and approaches of knowledge representation, planning and learning for improving machine intelligence.			H									
CO4	Able to develop the communication skill by presenting topics on Artificial Intelligent.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	As graduates will have to acquire knowledge on different types of agent architecture and working procedure.
CO2-POb	High	As the graduates will have to design solutions for real life engineering problems which can be solved by agent using different search techniques that meet specified needs with appropriate consideration.
CO3-POc	High	As the graduates will have to design solutions for real life engineering problems which can be solved by agent which is capable of representing knowledge, reasoning information, able to plan and learn in different scenario along with appropriate consideration.
CO4-POj	Medium	By presenting on different recent innovation of artificial intelligent embedded machine, graduates will have improved communication skill.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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 Uninformed Search II	
3	Lec 7 Lec 8 Lec 9	Informed Search I Informed Search II	

4	Lec 10 Lec 11 Lec 12	Memory Bounded Search I Memory Bounded Search II	Class Test 2
5	Lec 13 Lec 14 Lec 15	Beyond Classical Search I Beyond Classical Search II	
6	Lec 16 Lec 17 Lec 18	Adversarial Search I Adversarial Search II	
7	Lec 19 Lec 20 Lec 21	Constraint Satisfaction Problems I Constraint Satisfaction Problems II	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Planning with State Space Search Planning with Partial Order Search Graph Search	
9	Lec 25 Lec 26 Lec 27	Uncertainty and Probabilities Propositional Logic First Oder Logic	
10	Lec 28 Lec 29 Lec 30	Second Oder Logic	
11	Lec 31 Lec 32 Lec 33	Bayesian Rule Probabilistic reasoning Bayes Net	Class Test 3
12	Lec 34 Lec 35 Lec 36	Naive Bayes Belief Networks Decision Networks	
13	Lec 37 Lec 38 Lec 39	Perceptions Kernels and Clustering	
14	Lec 40 Lec 41 Lec 42	Learning General Logical description -Hypothesis. Introduction to Natural Language Processing.	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	CO1	C1, C2
			CO2	C2, C6
			CO3	C6, P3
	Class Attendance	5%	-	-
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C2, C6
			CO3	C6, P3
Final Exam		60%	CO2	C2, C6
			CO3	C6, P3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Artificial Intelligence: A Modern Approach (4th Edition) – Stuart Jonathan Russell, Peter Norvig; Prentice Hall (2020) Artificial Intelligence: A New synthesis – Nils J. Nilsson; Routledge
REFERENCE SITE
Google Classroom

CSE-404: Artificial Intelligence Sessional

COURSE INFORMATION				
Course Code	:	CSE 404	Lecture Contact Hours	: 3.00 hr, in alternating week
Course Title	:	Artificial Intelligence Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Hands on orientation with AI programming, intelligent agents along with how to representation, planning, learning and perception of knowledge of agents.
OBJECTIVE
4. To have general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas. 5. To develop programming skills for AI applications and explore traditional AI techniques and algorithms
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Applying, evaluating and valuing major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.	C2, C5, A3	1,2,7	2,5	1, 2, 8	ASG, Q
CO2	Analysing and evaluating programming skills for AI applications.	C4, C5			4, 6	ASG ,Q
CO3	Applying traditional AI techniques and algorithms for solving problem.	C3			4, 5	ASG, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT
Introduction to Intelligent Machines: State Mapping, BFS, DFS; **Searching:** A* Search, Iterative deepening A*; **Local search Algorithm**: hill climbing, first choice hill climbing, stochastic hill climbing; **Adversarial Search**: minimax, alpha-beta pruning; **Constraint Satisfaction Problem; Learning:** artificial neural network.
SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Applying, evaluating and valuing major concepts and approaches in		H										

	knowledge representation, planning, learning, robotics and other AI areas.												
CO2	Analysing and evaluating programming skills for AI applications.				H								
CO3	Applying traditional AI techniques and algorithms for solving problem.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO4	H	Graduates will conduct investigations on different approaches of knowledge representation, planning and learning for different agent to provide valid conclusions.
CO2-PO5	H	While analysing programming skill for AI application different modern IT tools will be used including prediction and modelling, to solve complex engineering problems, with an understanding of the limitations of the applications.
CO2-PO3	H	Traditional AI algorithms will be applied and solution will be designed by the graduates considering different context

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	5
Final Examination	1
Total	27

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lec-1,2	State Mapping Problem	3:00 hrs in alternate week
3	Lec-3,4	Informed Search Algorithm implementation	
5	Lec-5,6	Adversarial Search implementation	
7	Lec-7,8	Constraint Satisfaction Problem	
9	Lec-9,10	Naive Bayes, Decision Tree	
11	Lec-11,12	Artificial Neural Network	
13	Lec-13,14	Recurrent Neural Network, LSTM	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
	Task 1-3	30	CO3	C3
			CO3	C3

Continuous Assessment (80%)	Task 4-6	50	CO2	C4, C5
			CO2	C4, C5
Final Quiz		20	CO1	C2, C5, A3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Artificial Intelligence: A Modern Approach (4th Edition) – Stuart Jonathan Russell, Peter Norvig; Prentice Hall (2020)
2. Artificial Intelligence: A New synthesis – Nils J. Nilsson; Routledge Choco Solver Documentation - Charles Prud'homme, Jean-Guillaume Fages, Xavier Lorca

REFERENCE SITE

Google Classroom

CSE-4XO: Technical Elective-I

COURSE INFORMATION			
Course Code Course Title	: CSE-4XO : Technical Elective-I	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

***Details of all Technical Elective subjects are given later.**

GEEM-433: Engineering Ethics and Moral Philosophy

COURSE INFORMATION				
Course Code	:	GEEM-433	Lecture Contact Hours	:2.00
Course Title	:	Engineering Ethics and Moral Philosophy	Credit Hours	:2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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. Part of professional ethics is the understanding of the ethics of other professions: how they interact and what can be expected from them as correct ethical behavior. It elevates the profession and raises future standards and imprints on individual moral mindsets and behaviors.

OBJECTIVE

1. To develop a firm ethical base.
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 professionals.
3. To identify and analyze practical legal problems commonly encountered in the computing industry.

LEARNING OUTCOMES & GENERIC SKILLS						
No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the theoretical aspects of ethics and moral philosophy in professional fields.	C1-C2	1		1	T, F
CO2	Identify practical and legal problems commonly encountered by engineers in their professional industry.	C3	1		7	MT
CO3	Develop foundation knowledge of ethics to be and apply them to solve engineering problems.	C3-C6	3,5		3	F
CO4	Develop communication skills by presenting topics on Engineering Ethics and Moral Philosophy.	A2		1		Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T-Test; PR – Project; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Engineering Ethics: **Introduction to Ethics**; Theories of Ethics; **Principles of Engineering Ethics**; Ethical expectation: Employers and employees, Inter-professional relationship, **Standards and codes**: Fundamental Canons, NSPE codes, IEEE codes of conduct, ACM codes; Institutionalization of ethical conduct. Ethical Dilemmas, Choices (Whistle Blowing), **Computer Ethics**: Computer Crime and Cyber Security, Privacy and Confidentiality issue in CSE, Legal Framework in CSE-Copyright laws, ICT Act, Right To Information (RTI), Patents, and Royalty etc. Ethical Challenges for CSE Engineers with the advancement of Technology; **Case studies** related to ethical issues in ICT and other Engineering disciplines. Introduction to **Philosophy of Engineering**, metaphysics, epistemology, axiology, and logic.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the theoretical aspects of ethics and moral philosophy in professional fields.	M											
CO2	Identify practical and legal problems commonly encountered by engineers in their professional industry.		H										
CO3	Develop foundation knowledge of ethics to be and apply them to solve engineering problems.								M				
CO4	Develop the communication skill by presenting topics on Engineering Ethics and Moral Philosophy.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	Medium	Understand theoretical aspects of ethics and moral philosophy in professional fields.
CO2-PO2	High	Analyze & identify practical and legal problems commonly encountered by engineers in their professional industry.
CO3-PO8	Medium	Build foundation knowledge of ethics to be and apply them to solve engineering problems.

CO4-PO10	Low	Develop communication skills through participating in presentation etc.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28
Revision	14
Assessment Preparations	14
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	89

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1	Introduction to Ethics	Class Test 1
	Lec 2	Principles of Engineering Ethics	
2	Lec 3	Ethical expectation Employers and Employees	
	Lec 4	Relationship Obligation of an Engineer to Clients	
3	Lec 5	Professional Organization: ACM Standards and Codes	
	Lec 6	Institutionalization of Ethical Conduct	
4	Lec 7	NSPE codes	Class Test 2
	Lec 8	IEEE codes of conduct	
5	Lec 9	Ethical Problem-Solving Techniques	
	Lec 10	Ethical Problem-Solving Techniques	
6	Lec 11	Case study methodology, different case studies	
	Lec 12	Case study methodology, different case studies	
7	Lec 13	ICT Act Right to Information (RTI) Patents and Royalty	Mid Term Exam
	Lec 14	ICT Act Right to Information (RTI) Patents and Royalty	
8	Lec 15	Ethical Dilemmas	
	Lec 16	Choices (Whistle Blowing)	
9	Lec 17	Ethical Challenges for CSE Engineers	
	Lec 18	Ethical Challenges for CSE Engineers	
10	Lec 19	The Rights and Responsibilities of Engineers	
	Lec 20	Safety, Risk and Liability	
11	Lec 21	Computer Crime	
	Lec 22	Cyber Security Privacy	
12	Lec 23	Confidentiality Issue in CSE Legal Framework in	Class Test 3
	Lec 24	CSE Copyright laws	
13	Lec 25	Introduction to Philosophy of Engineering	
	Lec 26	Metaphysics	
14	Lec 27	Epistemology, Axiology and logic	
	Lec 28	Epistemology, Axiology and logic	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C2
	Class Participation	5%	CO 4	A2
	Mid term	10%	CO 2	C3
	Class Attendance	5%	-	-
Final Exam		60%	CO 1	C1-C2
			CO 3	C3-C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Engineering Ethics: Concepts and Cases (4th Edition) - Charles E. Harris
2. Engineering Ethics (4th Edition) - Charles B. Fleddermann,
3. The Elements Of Moral Philosophy – James Rachels & Stuart Rachels

REFERENCE SITE

LEVEL-4 FALL TERM

CSE-401: Information System Design and Development

COURSE INFORMATION				
Course Code	:	CSE 401	Lecture Contact Hours	: 3.00
Course Title	:	Information System Design and Development	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Information System Design and Development course motivates to perceive information systems planning, analysis, design and implementation; project management and maintenance, project scheduling and communication skills; as well as the fundamentals of security, disaster/recovery planning and ethics in system development to solve various real-life problems.

OBJECTIVE

1. To assist students for developing a comprehensive understanding of how information systems are developed.
2. To conduct the structured analysis and cost/benefit analysis for developing effective information systems.
3. To understand the importance of project management, maintenance, security and ethics of system development.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand fundamental concepts of information system, information system environment and primary responsibilities of a system analyst.	C1, C2	1,2,3,4,6	1,3,4,5	3	T, F
CO2	Apply the practical approaches of structured and cost-benefit analysis for developing information systems for industries/ business organizations.	C2, C3			4,5	T, MT, F
CO3	Analyse and organize a system using project management and maintenance techniques, and develop awareness regarding ethics and security of a system.	C4, C6			5,7	F
CO4	Develop the communication skill by presenting topics on information system design and development.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

System concepts: primary characteristics of a system, importance of system concepts for developing information systems; **Information systems environment:** elements of a system, information system types and features; **The system development lifecycle:** phases of SDLC, components of a feasibility study, factors to consider in a candidate system; **The role of the system analyst:** academic and personal qualification of a system analyst, multifaceted role of a system analyst, the analyst/user interface and behavioural issues; **Systems planning and the initial investigation:** importance and dimensions of planning, determining user's information requirements and prototyping; **Information gathering:** categories of information, sources of information and information gathering tools; **The tools of structured analysis:** data flow diagrams, data dictionary, structured English, decision trees, decision tables and their pros/cons; **Cost-benefit analysis:** classification of costs and benefits, cost-benefit analysis techniques and its advantages/disadvantages; **Project management techniques:** project attributes, constraints and stakeholders, project management knowledge areas, project management tools – Gantt charts, network diagrams, critical path analysis and estimating cost; **System maintenance:** primary activities of a maintenance procedure, reducing maintenance cost; **Security, disaster/recovery, and ethics in system development:** threats to system security and control measures, disaster/recovery planning, ethics codes and standards of behaviour in system development.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand fundamental concepts of information system, information system environment and primary responsibilities of a system analyst.	H											
CO2	Apply the practical approaches of structured and cost-benefit analysis for developing information systems for industries/ business organizations.			H									
CO3	Analyse and organize a system using project management and maintenance techniques. and develop awareness regarding ethics and security of a system.											H	
CO4	Develop the communication skill by presenting topics on information system design and development.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Identify information types, system environment and roles of a system analyst through an in-depth knowledge of information system fundamentals.
CO2-POc	High	Understand how to develop information systems by interpreting different types of business requirements and applying practical approaches of structured and cost-benefit analysis.
CO3-POk	High	Develop a system to formally manage and maintain projects in different environments following different principles and knowledge of project management techniques.
CO4-POj	Low	Develop communication skills through participating presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)

Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1	System concepts	Class Test 1
	Lec 2	System concepts (Contd.)	
	Lec 3	System concepts (Contd.)	
2	Lec 4	Information systems environment	
	Lec 5	Information systems environment (Contd.)	
	Lec 6	Information systems environment (Contd.)	
3	Lec 7	The system development lifecycle	
	Lec 8	The system development lifecycle (Contd.)	
	Lec 9	The system development lifecycle (Contd.)	
4	Lec 10	The role of the system analyst	Class Test 2
	Lec 11	The role of the system analyst (Contd.)	
	Lec 12	The role of the system analyst (Contd.)	
5	Lec 13	Systems planning	
	Lec 14	Systems planning (Contd.)	
	Lec 15	Systems planning (Contd.)	
6	Lec 16	Initial investigation	
	Lec 17	Initial investigation (Contd.)	
	Lec 18	Initial investigation (Contd.)	
7	Lec 19	Information gathering	Mid Term Exam
	Lec 20	Information gathering (Contd.)	
	Lec 21	Information gathering (Contd.)	
8	Lec 22	The tools of structured analysis	
	Lec 23	The tools of structured analysis (Contd.)	
	Lec 24	The tools of structured analysis (Contd.)	
9	Lec 25	The tools of structured analysis (Contd.)	
	Lec 26	The tools of structured analysis (Contd.)	
	Lec 27	The tools of structured analysis (Contd.)	
10	Lec 28	Cost-benefit analysis	
	Lec 29	Cost-benefit analysis (Contd.)	
	Lec 30	Cost-benefit analysis (Contd.)	
11	Lec 31	Cost-benefit analysis (Contd.)	Class Test 3
	Lec 32	Cost-benefit analysis (Contd.)	
	Lec 33	Cost-benefit analysis (Contd.)	
12	Lec 34	Project management techniques	
	Lec 35	Project management techniques (Contd.)	

	Lec 36	Project management techniques (Contd.)	
13	Lec 37	System maintenance	
	Lec 38	System maintenance (Contd.)	
	Lec 39	System maintenance (Contd.)	
14	Lec 40	Security, disaster/recovery, and ethics in system development	
	Lec 41	Security, disaster/recovery, and ethics in system development (Contd.)	
	Lec 42	Security, disaster/recovery, and ethics in system development (Contd.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C2, C3
	Class Attendance	5%	-	-
	Class Performance	5%	CO4	A2
	Mid term	10%	CO2	C2, C3
Final Exam		60%	CO1	C1, C2
			CO3	C4, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. System Analysis and Design (2nd Edition) by Elias M. Awad; Galgotia Publications Pvt. Ltd.
2. System Analysis and Design (2nd Edition) by Raja Raman; Prentice Hall
3. System Analysis and Design Methods (7th Edition) by Jeffery L. Whitten; McGraw Hill
4. System Analysis and Design (9th Edition) by Kendel & Kedel; Pearson

REFERENCE SITE

CSE-429: Computer Security

COURSE INFORMATION

Course Code	:	CSE-429	Lecture Contact Hours	: 3.00
Course Title	:	Computer Security	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

In the rapidly evolving landscape of information technology, the increasing reliance on interconnected systems and the digitalization of critical infrastructure make computer security a paramount concern. As technology advances, so do the sophistication and frequency of cyber threats, making it imperative for individuals with expertise in computer security to safeguard digital assets and protect sensitive information. This course fosters a culture of responsible digital citizenship and resilience in the face of emerging cyber threats.

OBJECTIVE

1. To understand the fundamental principles and concepts of Computer Security and be able to identify and examine potential threats in absence of those principles.

2.	To understand the fundamental principles and concepts of security attacks and objectives.
3.	To identify and analyse common security threats and vulnerabilities.
4.	To understand and implement traditional cryptographic techniques for secure communication and underlying principles behind mainstream cryptographic algorithms, specifically DES, AES, and RSA.
5.	To learn about contemporary security breaches and way to defend.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the fundamental principles and concepts of Computer Security, traditional encryption, security attacks and the security objectives.	C2	1, 2	1, 2	3	T, F
CO2	Identify and evaluate the security attacks, objectives and models, so is able to recognize the security requirements in real-life cases.	C5			1	M, T, F
CO3	Analyse the design and implementation issues of a real-life security solution.	C4			3	T, F
CO4	Able to develop the communication skill by presenting topics on Computer Security.	A2			5	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Fundamental concepts: confidentiality, integrity, availability, authenticity, accountability, threats and attacks, security principles; **Cryptographic concepts**: encryption, attacks on cryptosystems, cryptographic hash functions, digital certificates; **Cryptography**: overview, symmetric cryptography, classical encryption technique, DES, basics of finite fields, AES, key encryption and hash functions, public-key cryptography, RSA algorithm, key management, Diffie-Hellman key exchange, Message Authentication and Hash function, Hash Algorithm, Digital Signatures; **Security**: Operating systems concepts, process security, memory and file system security, physical security, application program security, network security concepts, browser security, applications security; **Exploiting Software**: Buffer Overflow Attacks , Format String Attacks, Dangling Pointers, Null Pointer Dereference Attacks, Integer Overflow Attacks, Command Injection Attacks, Time of Check to Time of Use Attacks; **Insider Attacks**: Logic Bombs, Back Doors, Login Spoofing ; **Malware**: Trojan Horses, Viruses, Worms, Spyware, Rootkits; **Defences**: Firewalls, Antivirus and Anti-Antivirus Techniques, Code Signing, Jailing, Model-Based Intrusion Detection, Encapsulating Mobile Code, Java Security; **Network Security**: Network Security practice, Authentication application, Wireless Network Security, Electrical Mail security, IP security and Web security; **Research on Security and Case Study**.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the fundamental principles and concepts of Computer Security, traditional encryption, security attacks and the security objectives.	H											
CO2	Identify and evaluate the security attacks, objectives and models, so is able to recognize the security requirements in real-life cases.		H										

CO3	Analyse the design and implementation issues of a real-life security solution.			H									
CO4	Able to develop the communication skill by presenting topics on Computer Security.											L	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Increase breadth & depth of knowledge through understanding the development of security, traditional encryption, security attacks and the fundamental security objectives
CO2-POb	High	Understand and solve various complex problems by analysing security objectives, attacks, and models.
CO3-POc	High	Understand and implement the design issues of real-life security solutions which have previously been identified and coded.
CO4-POj	Low	By presenting different security incidents and implementations of cryptographic algorithms students shall have the scope to develop communication skill.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Fundamental concepts of computer security Breach of Security Security Service, Security Mechanism	Class Test 1
2	Lec 4 Lec 5 Lec 6	Symmetric cipher Classical encryption technique	
3	Lec 7 Lec 8 Lec 9	Block Cipher Feistel Cipher Data Encryption Standard (DES)	
4	Lec 10 Lec 11 Lec 12	Data Encryption Standard (DES) Introduction to finite fields Advanced Encryption Standard (AES)	
5	Lec 13 Lec 14 Lec 15	Advanced Encryption Standard (AES) Public-key Cryptography	Class Test 2

6	Lec 16 Lec 17 Lec 18	RSA Algorithm Key Management	
7	Lec 19 Lec 20 Lec 21	Diffie-Hellman key exchange Public Key Cryptosystem Message Authentication and Hash function	
8	Lec 22 Lec 23 Lec 24	Hash Algorithm Digital Signatures Trusted Platform Modules	
9	Lec 25 Lec 26 Lec 27	Authentication using a physical object Authentication using biometrics Buffer Overflow Attacks	
10	Lec 28 Lec 29 Lec 30	Format String Attacks, Dangling Pointers, Null Pointer Dereference Attacks, Integer Overflow Attacks, Command Injection Attacks	Mid Term Exam
11	Lec 31 Lec 32 Lec 33	DoS Attack, SQL Injection Attacks, Cross Site Scripting Attacks, Man-in-the-middle Attacks Time of Check to Time of Use Attacks	
12	Lec 34 Lec 35 Lec 36	Slow Loris Attack, Logic Bombs, Back Doors, Login Spoofing, Trojan Horses, Viruses, Worms, Spyware, Rootkits Firewalls, Antivirus and Anti-Antivirus Techniques	Class Test 3
13	Lec 37 Lec 38 Lec 39	Cookie Stealing, Session Hijacking, Code Signing, Jailing, Model Based Intrusion, Detection, Encapsulating Mobile Code, Java Security Network Security practice, Authentication application	
14	Lec 40 Lec 41 Lec 42	Wireless Network Security, Electrical Mail security, IP security and Web security, Research on Security and Case Study, Win and Unix OS security architecture	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Bloom's Taxonomy**
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C5
			CO3	C4
	Class Performance	5%	CO4	A2
	Class Attendance	5%	-	-
	Mid term	10%	CO2	C5
			CO1	C2
Final Exam		60%	CO2	C5
			CO3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

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

REFERENCE SITE

CSE-430: Computer Security Sessional

COURSE INFORMATION

Course Code	: CSE 430	Lecture Contact Hours	: 1.50
Course Title	: Computer Security Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The inclusion of a computer security sessional course in undergraduate studies is essential due to the pervasive nature of digital technology in modern society. As digital systems become increasingly interconnected and reliant on data exchange, the risks associated with cyber threats escalate exponentially. This course aims to equip students with fundamental knowledge and skills to understand, prevent, and mitigate cyber threats. By delving into topics such as encryption, network security, authentication mechanisms, cyber security incidents and ethical considerations, students develop a comprehensive understanding of the principles and practices of computer security.

OBJECTIVE

6. To comprehend the fundamental concepts of computer security, types of cyber threats and develop understanding of potential vulnerabilities.
7. To instill a sense of security consciousness among students, emphasizing the importance of best practices such as strong password management, data encryption, and safe browsing habits.
8. To provide hands-on experience with security tools and encryption algorithms, and draw awareness of secure coding practices.
9. To simulate real-world scenarios and emphasizes the importance of clear communication in addressing security issues within organizations.

LEARNING OUTCOMES & GENERIC SKILLS

<table>
<tr><th>No.</th><th>Course Learning Outcome
(Upon completion of the course, the students will be able to)</th><th>Bloom's Taxonomy</th><th>CP</th><th>CA</th><th>KP</th><th>Assessment Methods</th></tr>
<tr><td>CO1</td><td>Understand the application of fundamental principles and concepts of Computer Security, traditional encryption and security attacks.</td><td>A2</td><td rowspan="4">1</td><td rowspan="4">1, 2</td><td></td><td>Q, ASG</td></tr>
<tr><td>CO2</td><td>Able to analyse and identify aspects of a potential security breach and apply available technique and technology to prevent such incidents.</td><td>A3, A4</td><td>3</td><td>T, Q, ASG</td></tr>
<tr><td>CO3</td><td>Able to use different tools to conduct foot printing and vulnerability assessment.</td><td>C2</td><td>3</td><td>T, Q</td></tr>
<tr><td>CO4</td><td>Develop the communication skill by presenting topics on Computer Security incidents and best practices.</td><td>A2</td><td>3</td><td>Pr</td></tr>
</table>

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Fundamental concepts: confidentiality, integrity, availability, authenticity, accountability, threats and attacks; Cryptographic concepts: encryption, simple attacks on cryptosystems, cryptographic hash functions, digital certificates; Cryptography: overview, symmetric cryptography, classical encryption technique, public-key cryptography, RSA algorithm, Diffie-Hellman key exchange, Message Authentication and Hash function, Digital Signatures; Security: Operating systems concepts, process security, memory and file system security, physical security, application program security, network security concepts, browser security, applications security; Exploiting Software: Buffer Overflow Attacks , Format String Attacks, Dangling Pointers, Null Pointer Dereference Attacks, Integer Overflow Attacks, Command Injection Attacks,; Insider Attacks: Logic Bombs, Back Doors, Login Spoofing; Malware: Trojan Horses, Viruses, Worms, Spyware, Rootkits; Defences: Firewalls, Antivirus and Anti-Antivirus Techniques, Code Signing, Jailing, Model-Based Intrusion Detection, Encapsulating Mobile Code, Java Security; Network Security: Network Security practice, Authentication application, Wireless Network Security, Electrical Mail security, IP security and Web security; Research on Security and Case Study.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the application of fundamental principles and concepts of Computer Security, traditional encryption and security attacks.		H										
CO2	Able to analyse and identify aspects of a potential security breach and apply available technique and technology to prevent such incidents.			H									
CO3	Able to use different tools to conduct foot printing and vulnerability assessment.					H							
CO4	Develop the communication skill by presenting topics on Computer Security incidents and best practices.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1 - POb	High	While the students learn fundamental principles and concepts of computer security, traditional encryption and security attacks they learn to analyse security incidents.
CO2 - POc	High	While the students learn to identify the reasons of probable security breech, they develop the understanding and skill to suggest measures for mitigation.
CO3 - POe	High	While the students complete different labs, they are oriented with different tools and become aware of using Tactics, Techniques and Procedures (TTPs) to prevent computer security incidents.
CO4 - POj	Low	In order to give a presentation on a selective project we need strong communication skills.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	3
Final Examination	1
Total	25

TEACHING METHODOLOGY			
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method			
COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2	Install open-source Latest version of Cryptool software and encrypt and decrypt the message using Simple Transposition – Permutation (Cryptool) Encrypt and decrypt the message using Caesar Cipher with Variable Key (Cryptool) Encrypt and decrypt the message using 3 X 3 Hill Cipher (Cryptool)	
2	Lec 3 Lec 4	Simple implementation of Data Encryption Standard (DES) algorithm Simple implementation of Advanced Encryption Standard (AES) algorithm	
3	Lec 5 Lec 6	Simple implementation of RSA algorithm Simple implementation of Diffie-Hellman key exchange algorithm	
4	Lec 7 Lec 8	**Footprinting and Scanning** Information Gathering Determining the Network Range Identifying the Active Machines Finding Open Ports and Access Points OS Fingerprinting Fingerprinting Services	
5	Lec 9 Lec 10	**Implementation/Simulation of Cyber Attacks and Mitigations** DoS Attack MITM Attack SQL Injection attack Cross-site scripting (XSS) Attack Cross-Site Request Forgery (CSRF) attack	
6	Lec 11 Lec 12	**Implementation/Simulation of Cyber Attacks and Mitigations** Active and passive sniffing ARP Poisoning Session Hijacking DNS Spoofing	
7	Lec 13 Lec 14	Recovery the password of windows machines using password recover utility (John the ripper) or any other utility Tracing of email origin using eMailTracePro utility or any other tool Using iptables to set up firewall rules, Various applications of iptables Installation and working of Open-source Firewall –Free BSD/iptables Firewall	
ASSESSMENT STRATEGY			

Components		Grading	CO	Bloom's Taxonomy
	Lab Test	20%	CO2	A3, A4

Continuous Assessment (40%)			CO3	C2
	Class Participation	5%	CO1	A2
	Assignment/Presentation	15%	CO2/CO4	C2/A2
Online Test – 1		20%	CO2	A3, A4
Online Test – 2		20%	CO3	C2
Viva/ Quiz		20%	CO2, CO3	A3, A4, C2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

REFERENCE SITE

CSE-413: Computer Graphics

COURSE INFORMATION

Course Code	: CSE 413	Lecture Contact Hours	: 3.00
Course Title	: Computer Graphics	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course deals with the fundamentals of computer graphics. This will emphasize the most basic algorithms and concepts in computer graphics that form the foundation for most modern graphics systems. It also deals with interactive 3D computer graphics, 2D algorithms, rendering, clipping, modelling and transformation, projection and so many graphics sectors.

OBJECTIVE

1. To provide a basic idea of computer graphics and their applications for understanding contemporary terminology, progress, issues, and trends.
2. To learn different computer graphics techniques and apply those to different fields.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the basic concepts of computer graphics, different graphics systems and applications of computer graphics.	C1, C2	1,2	5	1,2,3	T, MT, F
CO2	Interpret the mathematical foundation of the concepts of computer graphics and apply those concepts in different geometric objects.	C3, C4			2,3	T, MT, F
CO3	Analyze different algorithms and techniques of computer graphics and apply those in graphical models.	C3, C4, C6			5,6	F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Introduction: Computer graphics and its applications, Graphical Devices; **Vector tools for CG:** Basic operations of vectors, different representations of line & plane, line-line, line-plane intersections & plane-plane intersections; **Image representation**: Digital image representation, Raster Graphics representation, Vector Graphics representation, Gray Scale Frame buffer, true colour frame buffer, RGB model, CMY model, Grayscale conversion; **Scan Conversion**: Scan Converting point, Algorithm for scan converting a line, circle, ellipse, Region Filling, Aliasing and Anti-aliasing effect; **Modelling Transformations (2D & 3D):** Geometric transformation, Coordinate transformation, Composite transformation; **Viewing & Clipping:** Viewing transformations, Window to viewport mapping, Algorithms for Line and polygon clipping; **Projection**: Perspective projection, parallel projection, camera positioning; **Hidden Surface Removal:** Back face culling, painters algorithm, z-buffer algorithm, scanline algorithms, **Curves and Surfaces:** Polygon Mesh representation, plane equations, parametric cubic curves; **Light and Color models**; Color and Shading Model; Ray Tracing.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the basic concepts of computer graphics, different graphics systems and applications of computer graphics.	H											
CO2	Interpret the mathematical foundation of the concepts of computer graphics and apply those concepts in different geometric objects.		H										
CO3	Analyze different algorithms and techniques of computer graphics and apply those in graphical model.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Develop breadth & depth of knowledge by understanding the basic concepts of computer graphics like transformation of objects, modelling, projection, rendering, shading etc.
CO2-POb	High	Analyse and interpret different mathematical concepts to formulate different methods and techniques of computer graphics.
CO3-POc	High	Analyze different computer graphics algorithms to developing a solution of various engineering problems and apply in a correct way.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3

Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction: Computer graphics and its applications, Graphical Devices;	Class Test 1
2	Lec 4 Lec 5 Lec 6	**Vector tools for CG:** Basic operations of vectors, different representations of line & plane, line-line, line-plane intersections & plane-plane intersections;	
3	Lec 7 Lec 8 Lec 9	**Image representation**: Raster & Vector Graphics representation, Gray Scale & true colour frame buffer, RGB model, CMY model, Grayscale conversion;	
4	Lec 10 Lec 11 Lec 12	**Scan Conversion**: Scan Converting point, Algorithm for scan converting a line, circle, ellipse, Region Filling, Aliasing and Anti-aliasing effect;	Class Test 2
5	Lec 13 Lec 14 Lec 15	**Modelling Transformations (2D):** Geometric transformation, Coordinate transformation, Composite transformation;	
6	Lec 16 Lec 17 Lec 18	**Modelling Transformations (3D):** Geometric transformation, Coordinate transformation, Composite transformation;	
7	Lec 19 Lec 20 Lec 21	**Viewing & Clipping:** Viewing transformations, Window to viewport mapping, Algorithms for Line and polygon clipping;	
8	Lec 22 Lec 23 Lec 24	**Projection**: Perspective projection, parallel projection, camera positioning;	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	**Projection**: Parallel projection, camera positioning;	
10	Lec 28 Lec 29 Lec 30	**Hidden Surface Removal:** Back face culling, Painters algorithm	
11	Lec 31 Lec 32 Lec 33	**Hidden Surface Removal:** Z-buffer algorithm, scanline algorithms,	Class Test 3
12	Lec 34 Lec 35 Lec 36	**Curves and Surfaces:** Polygon Mesh representation, plane equations, parametric cubic curves	
13	Lec 37 Lec 38 Lec 39	**Light and Color models**	
14	Lec 40 Lec 41 Lec 42	Color and Shading Model Ray Tracing.	

ASSESSMENT STRATEGY

Components	Grading	CO	

				Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3/ Assignment	20%	CO1	C1, C2
			CO2	C3, C4
			CO3	C3, C4, C6
	Class Performance	5%	CO3	A2
	Class Attendance	5%	-	-
	Mid term	10%	CO2	C3, C4
			CO3	C3, C4, C6
Final Exam		60%	CO1	C1, C2
			CO2	C3, C4
			CO3	C3, C4, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Theory and Problems of Computer Graphics (2^{nd}) - Zhigang Xiang, Roy A. Plastock
2. Computer Graphics Principle and Practice (3^{rd}) - James D Foley, Van Dam
3. Computer Graphics using OpenGL (2^{nd}) by Francis S Hill, Jr.

REFERENCE SITE

CSE-414: Computer Graphics Sessional

COURSE INFORMATION

Course Code	:	CSE-414	Lecture Contact Hours	: 3.00
Course Title	:	Computer Graphics Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 create 3D games and animation using different modern graphics tools and software.

OBJECTIVE

1. To learn basic concepts of 2D, 3D and animation graphics projects using OpenGL graphics library.
2. To develop 3D games and animation using different software like Blender, unity, etc

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Apply graphics programming techniques to solve graphics problems related to modeling transformation, rendering, texture mapping, etc.	C3	1,2 3	1,2,3	3,5	ASG

CO2	Develop 2D and 3D graphical geometric objects.	C3, C6, A5			5	PR, ASG,
CO3	Create animation or real-time applications using open-source software.	C2, C6, P6			5,6	PR, Pr
CO4	Develop communication skills by presenting work done by individual and team during sessionals on topics of computer graphics	A2				

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Animation using OpenGL: Introduction to 2D Graphics and OpenGL. Drawing 2D geometric object, Simple 2D animation and modelling transformation using OpenGL, Drawing 3D geometric object and 3D animation in OpenGL

Animation using Blender/unity: Introduction to blender/ unity,3D modelling and Lighting in blender/unity texturing and coloring, rigging, rendering, animation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Apply graphics programming techniques to solve graphics problems related to modeling transformation, rendering, texture mapping etc.		H										
CO2	Develop 2D and 3D graphical geometric objects.			H									
CO3	Create animation or real-time applications using open-source software.					H							
C04	Develop communication skills by presenting work done by individual and team during sessionals on topics of computer graphics.									M			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POb	High	Apply the knowledge acquired in the theory class by analyzing the context of the problems and provide solutions to graphics problems.
CO2-POc	High	Develop 2D in OpenGL and 3D geometric objects in the Blender platform using the computer graphics concept.
CO3-POe	High	Different modern IT tools will be used to create animation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	

Non-face-to-face learning Revision Assessment Preparations	- - -
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1,2	Introduction to 2D Graphics and OpenGL. Drawing 2D geometric object	3.00 hrs in alternate week
2	Lec 3,4	Simple 2D animation and modelling transformation using OpenGL	
3	Lec 5,6	Drawing 3D geometric object and 3D animation in OpenGL	
4	Lec 7,8	Introduction to blender/ unity	
5	Lec 9,10	3D modelling and Lighting in blender/unity	
6	Lec 11,12	Texturing and coloring, Rigging	
7	Lec 13,14	Rendering, animation	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (100%)	2D Assignment	25%	CO1	C3
			CO2	C3, C6, A5
	3D Assignment	25%	CO1	C3
			CO2	C3, C6, A5
	Project	50%	CO2	C3, C6, A5
			CO3	C2, C6, P6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Theory and Problems of Computer Graphics (2^{nd}) - Zhigang Xiang, Roy A. Plastock
2. OpenGL programming guide (The official guide to learning OpenGL, 8^{th})- Dave Shreiner, Graham Sellers, John Kessenich, Bill Licea-Kane

REFERENCE SITE

GEPM-463: Project Management and Finance

COURSE INFORMATION

Course Code	:	GEPM-463	Lecture Contact Hours	: 2.00
Course Title	:	Project Management and Finance	Credit Hours	: 2.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Project Management and Finance course has been designed to understand the overlapping connection between engineering and management with financial matters through the study of Smart Technologies, Project Management and financial matters in an organization which will equip with the skills to understand the application of computing technology in real-world situations.
OBJECTIVE
1. To identify and analyze practical problems commonly encountered in the computing industry and formulate solutions by considering financial aspects to some of the 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 a computer professionals.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate different management and control frameworks and know their impact on the project management discipline.	C1-C3, P2	2, 3	1, 2	1, 2, 3, 4	T, F
CO2	Solve and apply cognitive skills and ability to identify, analysis, and articulate the importance of team building, project risk, and financial management.	C3-C4			1, 2, 3, 4	MT, F
CO3	Use management software to help plan and manage information technology projects.	C4			6	ASG, F
CO4	Apply modern engineering techniques, skills, and management principles to do work as a member and leader in a team, to manage projects in multidisciplinary environments.	C3-C4			7	T, F
CO5	Develop communication skills by presenting topics on project management and finance.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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; **Cost Management**: elements of cost of products, allocation of overhead costs, marginal costing, standard costing, cost planning and control, budget and budgetary control; **Development and planning process**: annual development plan, National budget; **Accounting in Action:** Meaning & Definition Of Accounting, Users And Uses Of Accounting, Why Ethics Is A Fundamental Accounting Concept, Accounting Standards And The Measurement Principles- Monetary Unit Assumption And The Economic Entity Assumption, Accounting Equation, The Effects Of Business Transactions On The Accounting Equation, The Five Financial Statements And How They Are Prepared, Ethics In Accounting, Engineering Accounting; **Financial management**: objectives, strategy, financing, performance analysis of the enterprise, investment appraisal, criteria of investment; **Marketing Management:** Concepts, strategy, sales promotion, patent laws; **Technology Management**: Management of innovation and changes, technology life cycle, Case studies;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate different management and control frameworks and know their impact on the project management discipline.	H											
CO2	Solve and apply cognitive skills and ability to identify, analysis, and articulate the importance of team building, project risk, and financial management.		H										
CO3	Use management software to help plan and manage information technology projects.					H							
CO4	Apply modern engineering techniques, skills and management principles to do work as a member and leader in a team, to manage projects in multidisciplinary environments.											H	
CO5	Develop communication skills by presenting topics on project management and finance.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Demonstrate different management and control frameworks and know their impact on the project management discipline, we need knowledge of science and engineering.
CO2-POb	High	Design and conduct experiments to identify, analysis, and articulate the importance of team building, project risk, and financial management.
CO3-POe	High	Use the techniques, skills, and modern engineering tools in order to use management software to help plan and manage information technology projects.
CO4-POk	High	Apply modern engineering tools, engineering techniques, skills and management principles to do work as a member and leader in a team, to manage projects in multidisciplinary environments
CO5-POj	Low	Develop strong communication skills through a presentation on the selective topics from the course taught.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28
Revision	14
Assessment Preparations	14

Formal Assessment Continuous Assessment Final Examination	 2 3
Total	89

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2	Engineering Management: Principles of management, Introduction to Project Management	Class Test 1
2	Lec 3 Lec 4	Project Integration Management; Project Scope Management; Project Time Management; Project Cost Management	
3	Lec 5 Lec 6	Project Quality Management; Project Human Resource Management; Project Risk Management	
4	Lec 7 Lec 8	MIS: Introduction, Decision Support Systems, MIS in decision making.	
5	Lec 9 Lec 10	Concept of Invention, Innovation, and Entrepreneurship; Cost management elements of cost of products, allocation of overhead costs	Class Test 2
6	Lec 11 Lec 12	Marginal costing, Standard costing; Cost planning and control, budget and budgetary control	
7	Lec 13 Lec 14	Development and planning process; annual development plan; National budget	
8	Lec 15 Lec 16	Meaning & Definition Of Accounting, Users And Uses Of Accounting; Accounting Standards And The Measurement Principles	
9	Lec 17 Lec 18	Monetary Unit Assumption And The Economic Entity Assumption, Accounting Equation, The Effects Of Business Transactions On The Accounting Equation	Mid Term Exam
10	Lec 19 Lec 20	The Five Financial Statements And How They Are Prepared, Debits And Credits, Business Transactions, The Basic Steps In The Recording Process- Journal, Ledger, T Account,Trial Balance	
11	Lec 21 Lec 22	Financial management : objectives, strategy, financing, performance analysis of enterprise	
12	Lec 23 Lec 24	Financial management : investment appraisal, criteria of investment;	
13	Lec 25 Lec 26	Marketing Management: Concepts, strategy, sales promotion, patent laws.	
14	Lec 27 Lec 28	Technology Management; Management of innovation and changes, technology life cycle, Case studies.	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C3
			CO4	C3
	Class Participation	5%	CO5	A2
	Class Attendance	5%	-	-
	Mid term	10%	CO2	C3-C4
Final Exam		60%	CO1	C1-C3, P2
			CO2	C3-C4

		CO3	C4
		CO4	C3-C4
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Project Management for Engineering, Business and Technology (5th) - John M. Nicholas, Herman Steyn,
2. Principles of Project Finance (1st) - E.R. Yescom
3. The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer (1st, McGraw-Hill Education, 2004) - J. Liker

REFERENCE SITE

TECHNICAL ELECTIVE - I

CSE-417: Blockchain and Cryptocurrency Technology

COURSE INFORMATION			
Course Code Course Title	: CSE-417 : Blockchain and Cryptocurrency Technology	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The course is designed to introduce Blockchain technology and its application to Computer Science. The course begins with the Basic Cryptographic primitives used in Blockchain and then covers, Basic Distributed System concepts, Basic Blockchain (Blockchain 1.0), Blockchain 2.0, Blockchain 3.0, Beyond Cryptocurrency, Limitations of blockchain as a technology

OBJECTIVE

1. To introduce Blockchain technology
2. To introduce the application of Blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the basic Cryptographic primitives used in Blockchain	C2-C3, A2	1,2	1	1	T, ASG, Viva
CO2	Develop decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies	C2, C3			1,2	T
CO3	Create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability	C2-C3			1-3	Mid Term, F
CO4	Develop the communication skills by presenting different topics on blockchain	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT

Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash; **Basic Distributed Computing:** Atomic Broadcast, Consensus, Byzantine Models of fault tolerance; **Basic Crypto primitives:** Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems; **Blockchain 1.0:** Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use; **Blockchain 2.0:** Ethereum and Smart

Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts; **Blockchain 3.0:** Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain; Privacy, **Security issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the basic Cryptographic primitives used in Blockchain	H											
CO2	Develop decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies		H										
CO3	Create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability			H									
CO4	Develop the communication skills by presenting different topics on blockchain										L		

(H – High, M- Medium, L-low)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lectures, class performance, Quiz, Viva, Lab tests, Report

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Need for Distributed Record Keeping Modeling faults and adversaries Byzantine Generals problem Consensus algorithms and their scalability problems	Class Test 1
2	Lec 4 Lec 5 Lec 6	Atomic Broadcast, Consensus	
3	Lec 7 Lec 8	Byzantine Models of fault tolerance	

	Lec 9		
4	Lec 10 Lec 11 Lec 12	Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures	Class Test 2
5	Lec 13 Lec 14 Lec 15	Public key crypto, verifiable random functions, Zero-knowledge systems	
6	Lec 16 Lec 17 Lec 18	Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake	
7	Lec 19 Lec 20 Lec 21	Alternatives to Bitcoin consensus, Bitcoin scripting language and their use	
8	Lec 22 Lec 23 Lec 24	Ethereum and Smart Contracts	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	The Turing Completeness of Smart Contract Languages and verification challenges	
10	Lec 31 Lec 32 Lec 33	Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	
11	Lec 28 Lec 29 Lec 30	Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain	Class Test 3
12	Lec 34 Lec 35 Lec 36	Pseudo-anonymity and anonymity	
13	Lec 37 Lec 38 Lec 39	Zcash and Zk-SNARKS for anonymity preservation	
14	Lec 40 Lec 41 Lec 42	Attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2, P3, A1
			CO2	C2, C3
	Class Participation	5%	CO4	C6, A2
	Mid term	10%	CO3	C2-C4
	Attendance	5%	-	-
Final Exam		60%	CO3	C2-C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

REFERENCE SITE

CSE-418: Blockchain and Cryptocurrency Technology Sessional

COURSE INFORMATION			
Course Title Course Code:	: CSE-318 : Blockchain and Cryptocurrency Technology Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
The course is designed to implement and analysis the Blockchain technology and its real time application to Computer Science. The course begins with the Basic Cryptographic primitives used in Blockchain and then covers, Basic Distributed System implementation and analysis of Basic Blockchain (Blockchain 1.0), Blockchain 2.0, Blockchain 3.0, Beyond Cryptocurrency, Limitations of blockchain as a technology

OBJECTIVE
1. To introduce and analysis Blockchain technology 2. To implement and analysis the Blockchain in cyber security, integrity of information, E-Governance and other contract enforcement mechanisms

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the basic Cryptographic primitives used in Blockchain	C2-C3, A2	1,2	1	1	T, ASG, Viva
CO2	Develop decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies	C2, C3			1,2	T
CO3	Create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability	C2-C3			1-3	Mid Term, F
CO4	Develop the communication skills by presenting different topics on blockchain	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; LT – Lab Test)

COURSE CONTENT
Introduction: Need for Distributed Record Keeping, Modeling faults and adversaries, Byzantine Generals problem, Consensus algorithms and their scalability problems, Technologies Borrowed in Blockchain – hash pointers, consensus, byzantine fault-tolerant distributed computing, digital cash; **Basic Distributed Computing:** Atomic Broadcast, Consensus, Byzantine Models of fault tolerance; **Basic Crypto primitives:** Hash functions, Puzzle friendly Hash, Collison resistant hash, digital signatures, public key crypto, verifiable random functions, Zero-knowledge systems; **Blockchain 1.0:** Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use; **Blockchain 2.0:** Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts; **Blockchain 3.0:** Hyperledger fabric, the plug and play platform and mechanisms in

permissioned blockchain; Privacy, **Security issues in Blockchain:** Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the basic Cryptographic primitives used in Blockchain	H											
CO2	Develop decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies		H										
CO3	Create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability			H									
CO4	Develop the communication skills by presenting different topics on blockchain										L		

(H – High, M- Medium, L-low)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	_
Assessment Preparations	_
Formal Assessment	
Continuous Assessment	3
Final Examination	1
Total	25

TEACHING METHODOLOGY

Lectures, class performance, Quiz, Viva, Lab tests, Report

COURSE SCHEDULE

Week	Lecture	Topics	Evaluation/ Assessment
1-2	Lab 1 Lab 2	Need for Distributed Record Keeping Modeling faults and adversaries **Implementation and analysis:** Byzantine Generals problem Consensus algorithms and their scalability problems	Class Performance, Assignment
3-4	Lab 3 Lab 4	**Implementation and analysis:** Atomic Broadcast, Consensus Byzantine Models of fault tolerance Hash functions, Puzzle friendly Hash, Collision resistant hash, digital signatures	Class Performance, Assignment, Report
5-6	Lab 5	**Implementation and analysis:**	Class Performance, Quiz

	Lab 6	Public key crypto, verifiable random functions, Zero-knowledge systems Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake	
7-8	Lab 7 Lab 8	**Implementation and analysis:** Alternatives to Bitcoin consensus, Bitcoin scripting language and their use Ethereum and Smart Contracts	Class Performance, Report
8-9	Lab 9 Lab 10	**Implementation and analysis:** The Turing Completeness of Smart Contract Languages and verification challenges Using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts	Class Performance, Assignment, Report
10-11	Lab 11 Lab 12	**Implementation and analysis:** Hyperledger fabric, the plug and play platform and mechanisms in permissioned blockchain Pseudo-anonymity and anonymity	Class Performance, Assignment, Quiz
12-13	Lab 13 Lab 14	**Implementation and analysis:** Zcash and Zk-SNARKS for anonymity preservation Attacks on Blockchains – such as Sybil attacks, selfish mining, 51% attacks - -advent of algorand, and Sharding based consensus algorithms to prevent these	Class Performance, Quiz, Assignment, Report

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	C1, C2, P3, A1
			CO3	C3
	Class Participation	5%	CO2	C2, C3
	Assignment/Presentation	15%	CO2/CO4	C2, C3/ A2
Online Test – 1		20%	CO1	C1, C2, P3, A1
Online Test – 2		20%	CO3	C2, C3, C5
Viva/ Quiz		20%	CO2, CO3	C2, C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

REFERENCE SITE

CSE-419: Advanced Algorithm

COURSE INFORMATION			
Course Code Course Title	: CSE-419 : Advanced Algorithm	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Select and explain a variety of algorithms with practical applications and the resource requirements of each.	P2, A2	2,3, 1,4	1, 5, 2	1	T
CO2	Determine the most suitable algorithm for any given task and then apply it to the problem.	C2-C4			2	MT, F
CO3	Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.	C4, C6			3-5	F
CO4	Develop the communication skill by presenting topics on advanced algorithms.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l

CO1	Select and explain a variety of algorithms with practical applications and the resource requirements of each.		H										
CO2	Determine the most suitable algorithm for any given task and then apply it to the problem.				H								
CO3	Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.	H											
CO4	Develop the communication skill by presenting topics on advanced algorithms.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	Complexity of analysis will be required to find suitable algorithm and resource
CO2-Pod	High	Optimized algorithm can be selected by breadth & depth of investigation and experimentation
CO3-POa	High	To prove the theory with proper logic, engineering knowledge is required
CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1	Introduction to Advanced Algorithms	Class Test 1
	Lec 2	Applications of Advanced Algorithms	
	Lec 3	Fundamental Algorithms vs Advanced Algorithms	
2	Lec 4	Randomized Algorithms	
	Lec 5	Las Vegas Algorithm	
	Lec 6	Las Vegas Algorithm (Contd.)	
3	Lec 7	Monte Carlo Algorithm	
	Lec 8	Monte Carlo Algorithm (Contd.)	
	Lec 9	Randomized Data Structures	

4	Lec 10 Lec 11 Lec 12	Skip Lists Amortized Analysis Amortized Analysis Methods	Class Test 2
5	Lec 13 Lec 14 Lec 15	Amortized Analysis Methods (Contd.) 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	Class Test 3
9	Lec 25 Lec 26 Lec 27	Fixed Parameter Tractability Parameterized Complexity Parameterized Complexity (Contd.)	
10	Lec 28 Lec 29 Lec 30	Fixed Parameter Algorithms Techniques of Designing Fixed Parameter Algorithms Techniques of Designing Fixed Parameter Algorithms	
11	Lec 31 Lec 32 Lec 33	Online Algorithms Online Algorithms (Contd.) Online Algorithms (Contd.)	Mid Term Exam
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.)	
14	Lec 40 Lec 41 Lec 42	Advanced Data Structures Linear Models Non-linear Models	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	P2, A2
	Presentation	5%	CO4	A2
	Mid term	10%	CO2	C2-C4
	Attendance	5%	-	-
Final Exam		60%	CO2, CO3	C2-C4, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)
REFERENCE SITE

CSE-420: Advanced Algorithm Sessional

COURSE INFORMATION				
Course Code	:	CSE 420	Lecture Contact Hours	: 1.50
Course Title	:	Advanced Algorithm Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course motivates to implement, analysis and apply 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 implement and analyze 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. 3. To develop some projects based on different techniques and methods of advanced algorithms. 4. To apply advanced algorithm in real-world scenarios and emphasizes the importance in different application.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate different advanced algorithms with practical applications and the resource requirements of each.	P2, A2	1, 2, 3, 4	1, 5, 2	1	Q, ASG
CO2	Determine the most suitable algorithm for any given task and then apply, implement and analyze it to the problem.	C3			2	T, Q, ASG
CO3	Demonstrate analyze the complexity and design necessary parameters of different techniques and methods of advanced algorithms when certain kinds of problems are intractable.	C6			3-5	T, Q
CO4	Develop the communication skill by presenting projects on advanced algorithms.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Randomized Algorithms: Las Vegas and Monte Carlo Algorithms; **Randomized Data Structures analysis:** 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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate different advanced algorithms with practical applications and the resource requirements of each.		H										
CO2	Determine the most suitable algorithm for any given task and then apply, implement and analyze it to the problem.				H								
CO3	Demonstrate analyze the complexity and design necessary parameters of different techniques and methods of advanced algorithms when certain kinds of problems are intractable.	H											
CO4	Develop the communication skill by presenting projects on advanced algorithms.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POb	High	Complexity of analysis will be required to find suitable algorithm and resource
CO2-POd	High	Optimized algorithm can be selected by breadth & depth of investigation and experimentation
CO3-POa	High	To prove the theory with proper logic, engineering knowledge is required
CO4-POe	High	Develop communication skills through participating in quiz, real time project presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centered Learning	-
Self-Directed Learning	

Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	- - -
Formal Assessment Continuous Assessment Final Examination	 03 01
Total	25

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1-2	Lab 1 Lab 2	Introduction to Advanced Algorithms Applications of Advanced Algorithms Fundamental Algorithms vs Advanced Algorithms **Implementation and analysis:** Randomized Algorithms Las Vegas Algorithm
3-4	Lab 3 Lab 4	**Implementation and analysis:** Monte Carlo Algorithm Randomized Data Structures **Implementation and analysis:** Skip Lists Amortized Analysis Methods
5-6	Lab 5 Lab 6	**Implementation and analysis:** Fibonacci Heaps Lower Bounds Decision Trees Information Theoretic Lower Bounds
6-7	Lab 7 Lab 8	**Implementation and analysis:** Adversary Arguments Approximation Algorithms Approximation Schemes Hardness of Approximation
8-9	Lab 9 Lab 10	**Implementation and analysis:** Fixed Parameter Tractability Parameterized Complexity Fixed Parameter Algorithms Techniques of Designing Fixed Parameter Algorithms
10-11	Lab 11 Lab 12	**Implementation and analysis:** Online Algorithms Competitive Analysis Online Paging Problem k-server Problem
12-13	Lab 13 Lab 14	External Memory Algorithms Advanced Data Structures Linear Models Non-linear Models

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	P2, A2
			CO4	A2
	Assignment/Presentation	15%	CO2,	C2,

			CO4	A2
	Class Participation	5%	CO2	C3
Online Test – 1		20%	CO1	P2, A2
Online Test – 2		20%	CO3	C6
Viva/ Quiz		20%	CO2, CO3	C3, C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)

REFERENCE SITE

CSE-421: Basic Graph Theory

COURSE INFORMATION

Course Code Course Title	: CSE-421 : Basic Graph Theory	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This corse is designed to provide 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

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Learn the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications	C1, C2	1	1,3,5	1, 2	T, F
CO2	Explain and discuss mathematical proofs, including an appreciation of why this is important.	C2, C6			3, 4, 8	T, F

CO3	Formulate algorithms to solve problems with graph theories	C3			5	Mid, F
CO4	Develop the communication skill by presenting topics on operating systems.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Learn the standard uses of graphs as models and the fundamental theory about graphs with a sense of some of its modern applications	H											
CO2	Explain and discuss mathematical proofs, including an appreciation of why this is important.				H								
CO3	Formulate algorithms to solve problems with graph theories			H									
CO4	Develop the communication skill by presenting topics on operating systems.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Recognize the standard uses of graphs and the fundamental theory about graphs with a sense of some of its modern applications
CO2-POd	High	Understand mathematical proofs and apply them in real research problems.
CO3-POc	High	Develop algorithms to solve problems with graph theories
CO4-POj	Medium	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	--
Student-Centred Learning	--
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method, Regular Assessment.

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Graphs and their applications	Class Test 1
2	Lec 4 Lec 5 Lec 6	Basic graph terminologies	
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	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Trees and counting of trees	
10	Lec 28 Lec 29 Lec 30	Graceful labelling Matching and covering	
11	Lec 31 Lec 32 Lec 33	Distance in graphs Distance in trees	Class Test 3
12	Lec 34 Lec 35 Lec 36	Planar graphs	
13	Lec 37 Lec 38 Lec 39	Digraphs Graph colouring	
14	Lec 40 Lec 41 Lec 42	Special classes of graphs	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C2, C6
			CO3	C3
	Class Participation	5%	CO4	A2

	Mid term	10%	CO2	C2, C6
			CO3	C3
	Attendance	5%		
Final Exam		60%	CO3	C3
			CO2	C2, C6
			CO1	C1, C2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to graph theory (4^{th}) - Douglas B West
2. Introduction to Graph Theory (5^{th}) - Robin J. Wilson, Pearson Education Asia

REFERENCE SITE

CSE-422: Basic Graph Theory Sessional

COURSE INFORMATION

Course Code Course Title	: CSE 422 :Basic Graph Theory Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course introduces graph theory, covering fundamental concepts, algorithms, and applications. Students will learn about different types of graphs, graph representation, traversal algorithms, minimum spanning trees, shortest path algorithms, graph coloring, network flow problems, matching in graphs, and applications of graph theory in various fields.

OBJECTIVE

1. To introduce graph theory, covering fundamental concepts, algorithms, and applications
2. To analyze different types of graphs, graph representation, traversal algorithms, minimum spanning trees, shortest path algorithms, graph coloring, network flow problems, matching in graphs, and applications of graph theory in various fields.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to achieve the following.)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand fundamental graph theory concepts and terminologies,	C1-C6, P1, P6	1	1	6	T, Q

	including graph representation and traversal algorithms.					
CO2	Apply graph algorithms such as minimum spanning trees and shortest path algorithms to solve graph-related problems.	C3, C6, A4, A5, P6	2	2	8	ASG, T
CO3	Analyze and interpret real-world applications of graph theory, developing problem-solving skills through practical sessions and assignments.	C2 – C6 P1, A1, A2	6	4	2	R, Q, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Define basic terminologies in graph theory such as vertices, edges, degree, and types of graphs (directed, undirected, weighted, etc.). using networkxy, explore graph traversal algorithms including Depth-First Search (DFS) and Breadth-First Search (BFS) to visit and explore all the vertices of a graph. Understand the concept of minimum spanning trees and learn algorithms such as Prim's and Kruskal's to find the minimum spanning tree of a connected, weighted graph. Learn algorithms such as Dijkstra's and Bellman-Ford to find the shortest paths between vertices in a weighted graph Understand the basics of graph coloring and apply greedy coloring algorithm to color the vertices of a graph with minimum number of colors. Learn about network flow problems and algorithms such as Ford-Fulkerson for finding maximum flow and minimum cut in a flow network. Understand the concept of matching in graphs, particularly in bipartite graphs, and learn algorithms such as Hopcroft-Karp for finding maximum matching.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand fundamental graph theory concepts and terminologies, including graph representation and traversal algorithms.	H											
CO2	Apply graph algorithms such as minimum spanning trees and shortest path algorithms to solve graph-related problems.		H										
CO3	Analyze and interpret real-world applications of graph theory, developing problem-solving skills through practical sessions and assignments.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Able to understand the structure of graph and its applications
CO2-POb	High	Able to Utilize graph algorithms, including those for minimum spanning trees and shortest paths, to address various graph-related challenges effectively.

CO3-POc	High	Able to Examine real-world applications of graph theory, fostering problem-solving abilities through hands-on exercises and assignments.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 2 - 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab -1, 2	Introduce network Define basic terminologies in graph theory such as vertices, edges, degree, and types of graphs (directed, undirected, weighted, etc.). using networkxy	3.00 in alternate week
3	Lab -3, 4	Learn different methods for representing graphs including adjacency matrices, adjacency lists, and incidence matrices.	
5	Lab -5, 6	Explore graph traversal algorithms including Depth-First Search (DFS) and Breadth-First Search (BFS) to visit and explore all the vertices of a graph.	
7	Lab -7, 8	Understand the concept of minimum spanning trees and learn algorithms such as Prim's and Kruskal's to find the minimum spanning tree of a connected, weighted graph.	
9	Lab -9, 10	Learn algorithms such as Dijkstra's and Bellman-Ford to find the shortest paths between vertices in a weighted graph.	
11	Lab -11, 12	Understand the basics of graph coloring and apply greedy coloring algorithm to color the vertices of a graph with minimum number of colors. Learn about network flow problems and algorithms such as Ford-Fulkerson for finding maximum flow and minimum cut in a flow network.	

13	Lab -13, 14	Understand the concept of matching in graphs, particularly in bipartite graphs, and learn algorithms such as Hopcroft-Karp for finding maximum matching.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5
	Class Participation	10%	CO3	C4, A2, A1
	Presentation	10%	CO2	C6, A4, P3
Final Exam (Online Test + Quiz)		40%	CO1, CO3	C2-C6, P1
			CO3	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to Graph Theory" by Richard J. Trudeau Machine Learning - Tom Mitchell, McGraw Hill
2. Graph Theory and Its Applications" by Jonathan L. Gross and Jay Yellen

REFERENCE SITE

CSE-423: Fault Tolerant System

COURSE INFORMATION

Course Code Course Title	: CSE-423 : Fault Tolerant System	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 analyse the faults in order to create a reliable and high-performance system.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Explain underlying notions of fault tolerance and various aspect of typical design process.	C2			4, 5	T, MT, F
CO2	Analyse reliability of different types of systems.	C4			4, 5	T, MT, F
CO3	Recognize defect avoidance and circumvention.	C5	1 2	1	4, 5	T, MT, F
CO4	Identify methodologies of hardening systems.	C3			4,5	T, MT, F
CO5	Develop the communication skill by presenting topics on Fault Tolerance.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Introduction of Fault Tolerant Systems and architectures; Goal and Application of Fault Tolerant computing, Fundamental Definitions, Design techniques to achieve fault Tolerance; Reliability Modelling Using Probability Theory; **Detection:** Fault detection and location in combinational and sequential circuits; **Test:** Fault test generation for combinational and sequential circuits; **Fault modelling**: Faults in memory, memory test pattern and reliability; **Performance monitoring:** self-checking circuits, burst error correction and triple modular redundancy, **Defect:** defect avoidance, defect circumvention, shield and hardening, yields enhancement, degradation Allowance;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Explain underlying notions of fault tolerance and various aspect of typical design process.		H										
CO2	Analyse reliability of different types of systems.		H										
CO3	Recognize defect avoidance and circumvention.		H										
CO4	Identify methodologies of hardening systems.		H										
CO5	Develop the communication skill by presenting topics on Fault Tolerance.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	In order to explain different fault tolerant system, one must have to reach substantiated conclusions using knowledge of engineering sciences.
CO2-POb	High	By analysing reliability of system, graduates will be more capable of analysing complex engineering problems.
CO3-POb	High	To recognize defect of system, graduates will have to research on the system to formulate it and make conclusion.
CO4-POb	High	In order to identify methodologies to harden a system, one must have to identify, formulate, research to get conclusion.
CO5-POj	Low	As the graduates will have to present on some topic of fault tolerant system, it will help them to improve their communication skill.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)

Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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 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 Modelling	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.)	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Error Correction Burst Error Burst Error Correction	
10	Lec 28 Lec 29 Lec 30	N-modular Redundancy Triple Modular Redundancy Triple Modular Redundancy (Contd.)	
11	Lec 31 Lec 32 Lec 33	Defect Defect Types Defect Avoidance	Class Test 3
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	Yields Enhancement Yields Enhancement (Contd.)	

	Lec 42	Degradation Allowance	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1-CO4	C2, C3, C4, C5
	Class Participation	5%	CO5	A2
	Mid term	10%	CO1-CO4	C2, C3, C4, C5
	Attendance	5%		
Final Exam		60%	CO1	C2
			CO2	C4
			CO3	C5
			CO4	C3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Fault-Tolerant Systems, 2nd Edition - Israel Koren, C. Mani Krishna (2020)
2. Design and Analysis of Fault Tolerant Digital System (1st Edition) - Barry W. Johnson; Addison Wesley (1989)
3. Dependable Computing: A Multilevel Approach - Behrooz Parhami

REFERENCE SITE

CSE-424: Fault Tolerance System Sessional

COURSE INFORMATION

Course Code	: CSE 424	Lecture Contact Hours	: 3.00 hrs in alternative week
Course Title	: Fault Tolerance System Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Analyse reliability of different types of systems.	C1-C6, P1, P6	1, 2, 6, 3, 7	1, 2, 3, 4	6	T, Q
CO2	Recognize defect avoidance and circumvention	C3, C6, A4, A5, P6			8	ASG, T
CO3	Identify methodologies of hardening systems.	C2 – C6 P1, A1, A2			2	R, Q, Pr
CO4	Develop the communication skill by presenting topics on Fault Tolerance.	P3, A4, C3, C4, C6			5	T, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Introduction of Fault Tolerant Systems and architectures; Goal and Application of Fault Tolerant computing, Fundamental Definitions, Design techniques to achieve fault Tolerance; Reliability Modelling Using Probability Theory; Detection: Fault detection and location in combinational and sequential circuits; Test: Fault test generation for combinational and sequential circuits; Fault modelling: Faults in memory, memory test pattern and reliability; Performance monitoring: self-checking circuits, burst error correction and triple modular redundancy, Defect: defect avoidance, defect circumvention, shield and hardening, yields enhancement, degradation Allowance;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Analyse reliability of different types of systems.		H										
CO2	Recognize defect avoidance and circumvention			H									
CO3	Identify methodologies of hardening systems.				H								
CO4	Develop the communication skill by presenting topics on Fault Tolerance.										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POb	High	Able to understand the complexity in analysis of system.
CO2-POc	High	Capable of determining which contemporary tools are appropriate.
CO3-POd	High	Able to appreciate the mathematical relationships and in-depth investigation and experimentation of the paradigms of systems.
CO4-POj	High	Able to design and implement the relevant systems.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 02 - 03
Total	26

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Lecture**	**Topics**
1-2	Lab -1, 2	Reliability Modelling using Probability Theory
3-4	Lab -3, 4	Fault Detection and Location in Sequential Circuit
5-6	Lab -5, 6	Fault Detection and Location in Combinational Circuit
6-7	Lab -7, 8	Fault Test Generation for Sequential Circuit Fault Test Generation for Combinational Circuit
8-9	Lab -9, 10	Memory Test Pattern & Memory Test Reliability
10-11	Lab -11, 12	N-modular Redundancy, Triple Modular Redundancy
12-13	Lab -13, 14	Defect Avoidance and Defect Circumvention

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5
	Class Participation	10%	CO3	C4, A2, A1
	Presentation	10%	CO2	C6, A4, P3
Final Exam (Online Test + Quiz)		40%	CO1, CO3	C2-C6, P1
			CO4	P3, A4

Total Marks	100%

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Fault-Tolerant Systems, 2nd Edition - Israel Koren, C. Mani Krishna (2020)
2. Design and Analysis of Fault Tolerant Digital System (1st Edition) - Barry W. Johnson; Addison
3. Wesley (1989)
4. Dependable Computing: A Multilevel Approach - Behrooz Parhami

REFERENCE SITE

CSE-425: Basic Multimedia Theory

COURSE INFORMATION

Course Code Course Title	: CSE-425 : Basic Multimedia Theory	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 analyse different issues - storing, indexing, resource management, scheduling, security etc. of multimedia applications.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the fundamental concepts like indexing and storing multimedia data for multimedia document.	C1-C2	1,2,4	1	1	T, F
CO2	Analyse different techniques and problems for multimedia document.	C2, C4			2,3	T, F, MT
CO3	Discover and apply the knowledge acquired in developing multimedia applications – audio and video conferencing, video	C3-C5			5	MT, F, ASG

	on demand, and voice over IP.					
CO4	Develop the communication skill by presenting topics on computer graphics.	A2			-	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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 issue**s; 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.

SKILL MAPPING

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the fundamental concepts like indexing and storing multimedia data for multimedia document.	H											
CO2	Analyse different techniques and problems for multimedia document.		H										
CO3	Discover and apply the knowledge acquired in developing multimedia applications – audio and video conferencing, video on demand, and voice over IP.			H									
CO4	Develop the communication skill by presenting topics on computer graphics.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Develop a strong knowledge on multimedia theory and technology by understanding the basic concepts related to it.
CO2-POb	High	Analyse different techniques to apply in various engineering problems.
CO3-POc	High	Develop multimedia applications by analysing different requirements and techniques.
CO4-POj	Low	Develop communication skills through participating in presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	42

Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Multimedia System, Application of Multimedia System	Class Test 1
2	Lec 4 Lec 5 Lec 6	Coding and Compression Standards, Architecture Issues in Multimedia	
3	Lec 7 Lec 8 Lec 9	Operating System Issues in Multimedia, Real-time OS	
4	Lec 10 Lec 11 Lec 12	Synchronization Issues, Interrupt Handling	Class Test 2
5	Lec 13 Lec 14 Lec 15	Database Issues in multimedia, Indexing and Storing multimedia data	
6	Lec 16 Lec 17 Lec 18	Disk placement and scheduling	
7	Lec 19 Lec 20 Lec 21	Searching for a multimedia document, Networking issues in multimedia	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Quality of Service guarantees, Resource reservation, traffic specification	
9	Lec 25 Lec 26 Lec 27	Shaping, monitoring & admission control	
10	Lec 28 Lec 29 Lec 30	Multicasting issues, Session directories	
11	Lec 31 Lec 32 Lec 33	Protocol for controlling sessions, Security issues in multimedia	Class Test 3
12	Lec 34 Lec 35 Lec 36	Digital water marking, partial encryption schemes for video streams	
13	Lec 37 Lec 38 Lec 39	Multimedia application, audio and video conferencing	
14	Lec 40 Lec 41 Lec 42	Video on demand, Voice over IP	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C2
			CO2	C2, C4
			CO3	C3-C5
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C2, C4
			CO3	C3-C5
	Attendance	5%		
Final Exam		60%	CO1	C1-C2
			CO2	C2, C4
			CO3	C3-C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Multimedia: Computing, Communications & Applications (US Edition) - Ralf Steinmetz, Klara Nahrstedt

REFERENCE SITE

CSE-426: Basic Multimedia Theory Sessional

COURSE INFORMATION

Course Code	:	CSE 426	Lecture Contact Hours	: 3.00 hrs in alternative week
Course Title	:	Basic Multimedia Theory Sessional	Credit Hours	: 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The lab course serves to reinforce the theoretical concepts introduced in Basic Multimedia Theory by providing hands-on experience in multimedia system implementation and analysis.

OBJECTIVE

1. Apply techniques and methods for developing secure and high-quality multimedia applications.
2. Recognize and analyze issues related to multimedia applications, including storage, indexing, resource management, and security.
3. Gain practical experience in developing multimedia applications such as audio and video conferencing, video on demand, and voice over IP.

4. Enhance communication skills through presentations on multimedia-related topics.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Implement multimedia applications using appropriate techniques and methods.	C2, C3	1, 3	1, 2	2,3	T, R, ASG
CO2	Analyze issues related to multimedia applications and propose solutions.	C2, C4			3, 4	R, ASG, Pr
CO3	Develop multimedia applications including audio and video conferencing, video on demand, and voice over IP.	C3-C5			5,6	R, ASG, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Multimedia Systems: Introduction and Applications Coding and Compression Standards Architecture Issues in Multimedia Operating System Issues in Multimedia: Real-time OS Synchronization and Interrupt Handling Database Issues in Multimedia: Indexing and Storing Multimedia Data Disk Placement and Scheduling Searching for Multimedia Documents Networking Issues in Multimedia: Quality of Service Guarantees, Resource Reservation Traffic Specification, Shaping, and Monitoring Multicasting Issues and Session Directories Protocols for Controlling Sessions and Security Issues in Multimedia Digital Watermarking and Encryption Schemes for Video Streams Multimedia Applications: Audio and Video Conferencing, Video on Demand, Voice over IP

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Implement multimedia applications using appropriate techniques and methods.	H											
CO2	Analyze issues related to multimedia applications and propose solutions.		H										
CO3	Develop multimedia applications including audio and video conferencing, video on demand, and voice over IP.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Enhance understanding of multimedia theory by practical application
CO2-POb	High	Facilitates critical analysis of diverse engineering techniques in multimedia context.
CO3-POc	High	Cultivate skills in developing multimedia applications through comprehensive analysis and synthesis.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 02 - 03
Total	26

TEACHING METHODOLOGY

Hands-on Lab Sessions, Demonstration of Software Tools, Problem-Based Learning Approach

COURSE SCHEDULE

Week	Lecture	Topics
1-2	Lab -1, 2	Introduction to Multimedia Systems and Applications, Coding and Compression Standards
3-4	Lab -3, 4	Architecture Issues in Multimedia, Real-time OS and Synchronization
5-6	Lab -5, 6	Database Issues: Indexing and Storing Multimedia Data, Disk Placement and Scheduling
6-7	Lab -7, 8	Networking Issues: Quality of Service Guarantees, Resource Reservation, Traffic Specification, Shaping, and Monitoring
8-9	Lab -9, 10	Multicasting Issues and Session Directories, Protocols for Controlling Sessions and Security Issues
10-11	Lab -11, 12	Digital Watermarking and Encryption Schemes, Multimedia Applications: Audio and Video Conferencing, Multimedia Applications: Video on Demand and Voice over IP
12-13	Lab -13, 14	Final Project and Presentation

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Reports and Assignments	40%	CO1	C2, C3
			CO2	C2, C4
	Lab Performance and Participation	10%	CO3	C3-C5
	Presentation	10%	CO2	C2, C4
Final Exam (Online Test + Quiz)		40%	CO2	C2, C4
			CO1, CO3	C2-C5

Total Marks	100%

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS
Multimedia: Computing, Communications & Applications (US Edition) by Ralf Steinmetz, Klara Nahrstedt
REFERENCE SITE

CSE-427: Digital Image Processing

COURSE INFORMATION			
Course Code Course Title	: CSE-427 : Digital Image Processing	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Digital Image Processing course is designed to introduce the fundamentals of image processing and manipulation of television, medical imaging modalities such as X-Ray, Ultrasound (US), MRI, photography, security, astronomy and remote sensing.
OBJECTIVE
1. To describe image formation and the role human visual system plays in perception of gray and colour 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.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand image formation and the role of human visual system in perception of gray and colour image data	C2	1, 2	1	3	T, F
CO2	Evaluate the basic objectives and applications of image processing	C5			5	T, M, F
CO3	Analyze image sampling and quantization requirements and implications	C4			3	T, F, PR
CO4	Able to develop the communication skill by presenting topics on operating systems	A2			5	Q, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Digital image fundamentals: visual perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic relationships between 245 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 Filter, Image Segmentation**.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand image formation and the role of human visual system in perception of gray and colour image data	H											
CO2	Evaluate the basic objectives and applications of image processing		H										
CO3	Analyze image sampling and quantization requirements and implications			H									
CO4	Able to develop the communication skill by presenting topics on operating systems										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – POa	High	Amplify depth of knowledge through understanding the image formation and the role of human visual system in perception of gray and color image data is very important.
CO2 – POb	High	Understand and solve various complex problems by analysing the basic elements and applications of image processing.
CO3 – POc	High	Understand and implement the design issues required to develop and analyse image sampling and quantization requirements and implications.
CO4–POj	High	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Mid Term Exam	1
Final Examination	3
Total	132

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Digital image fundamentals, Visual perception Light and Electron genetic Spectrum	Class Test 1
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)	
4	Lec 10 Lec 11 Lec 12	Discrete Cosine Transform (DCT) Karhunen and Loeve Transform (KLT)	Class Test 2
5	Lec 13 Lec 14 Lec 15	Wavelet Transform	
6	Lec 16 Lec 17 Lec 18	Sub-Band Decomposition	
7	Lec 19 Lec 20 Lec 21	Image restoration technique, Properties of Noise Estimation of Noise Parameters	
8	Lec 22 Lec 23 Lec 24	Filters, Mean Filter, Bandpass and Band reject Filter, Notch Filter and Inverse Filter	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Color Image Processing, Fundamentals, Models Smoothing and Sharpening	
10	Lec 28 Lec 29 Lec 30	Image compression techniques, Coding Redundancy, Measuring Image Information	
11	Lec 31 Lec 32 Lec 33	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	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
	Test 1-3	20%	CO1	C2
			CO2	C5

Continuous Assessment (40%)			CO3	C4
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C5
	Attendance	5%		
Final Exam		60%	CO1	C2
			CO2	C5
			CO3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Digital Image Processing (3rd/2nd Edition) - R. C. Gonzalez and R.E. Woods; Pearson Prentice Hall (2009)

REFERENCE SITE

CSE-428: Digital Image Processing Sessional

COURSE INFORMATION

Course Code	: CSE 428	Lecture Contact Hours Credit Hours	: 1.50 : 0.75
Course Title	: Digital Image Processing Sessional		

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to give undergraduate students all the fundamentals in 2-D digital image processing with emphasis in image processing techniques including colour imaging, histogram processing, image filtering, morphological operations and segmentation required for real-life problems and applications.

OBJECTIVE

1. To achieve a basic idea about 2-D digital image processing.
2. To gain experience and practical techniques to write programs using MATLAB/Python language for digital manipulation of images; image acquisition; pre-processing; segmentation.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand 2-D image and 2-D image processing problems and select suitable techniques that can offer a solution	C2, A2	-	1, 2	5	T, Q, ASG, R

CO2	Implement solution for 2-D image processing problems through group project work	C3, A5			6	PR
CO3	Develop oral and written communication skills to deliver solution on 2-D image processing problems	P3, A4			2	Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to 2-D image with MATLAB/Python and other tools for 2-D image processing problems

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand 2-D image processing problems and select suitable techniques that can offer a solution				H								
CO2	Implement solution to real life 2-D image processing problems through group project work									H			
CO3	Develop oral and written communication skills to deliver solution on 2-D image processing problems										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1 – Pod	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of 2-D image processing algorithms and selecting appropriate solution
CO2 – Poi	High	Able to analyse and implement solution of 2-D image processing tasks
CO3-POj	High	Able to develop communication skills through writing reports and presenting them

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning Revision	-
Assessment Preparations	-
Non-face-to-face learning Revision	-
Formal Assessment	
Continuous Assessment	02

Mid-Term Exam	-
Final Examination	03
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1-2	Lab 1,2	Introduction to MATLAB/Python Script for 2-D image processing problems (color models, conversion of color image to grayscale images, Histogram processing)
3-4	Lab 3,4	Introduction to 2-D image pre-processing problems (Enhancement, Filtering) Real Life Problem Scenario Home Assignment
5-6	Lab 5,6	Introduction to 2-D image pre-processing problems (Morphological operation) Real Life Problem Scenario Home Assignment Project Idea Distribution
6-7	Lab -7, 8	Networking Issues: Quality of Service Guarantees, Resource Reservation, Traffic Specification, Shaping, and Monitoring
8-9	Lab 9,10	Identification Home Assignment Project Proposal Presentation
10-11	Lab -11, 12	Review of pre-processing Project Update
12-13	Lab -13, 14	Quiz Viva Project Final Submission

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test and Assignment	30%	CO1	C2, A2
			CO1	C2, A2
	Class Participation	20%	CO3	P3, A4
	Presentation	10%	CO3	P3, A4
Project		40%	CO2	C3, A5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1.“Digital Image Processing”. Author(s)/Editor(s): R. C. Gonzalez and R. E. Woods. Publisher: Pearson-Prentice-Hall, 2008 ISBN: 0-13-168728-x, 978-0-13-168728-8 Edition: third.
2.“Digital Image Processing using Matlab”. Author(s)/Editor(s): R. C. Gonzalez, R. E. Woods, S. L. Eddins. Publisher: Pearson-Prentice-Hall, 2004 ISBN: 0-13-008519-7 Edition: 2nd.

REFERENCE SITE

CSE-431: Object Oriented Software Engineering

COURSE INFORMATION			
Course Code Course Title	: CSE 431 : Object Oriented Software Engineering	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Object-Oriented Software Engineering 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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Describe various O-O concepts along with their applicability contexts.	C1, C2	1, 3	1,3	1	T, F
CO2	Identify domain objects, their properties, and relationships among them.	C1, C2, C4			1	MT, F
CO3	Model/ represent domain constraints on the objects and (or) on their relationships.	C6			3	T, F
CO4	Develop design solutions for problems on various O-O concepts.	C3, C6			6	T, F
CO5	Develop the communication skill by presenting topics on object-oriented software engineering.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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:** exception handling, repeated inheritance, typing problems, and parallelism; **Object-oriented software engineering process:** concentrating on specific guidelines, facilitate the translation OOAD to a maintainable address; **Verification and validation (V&V) issues of Eiffel software systems built in a software engineering context**: the building of a parallel linear algebra library (Paladin).

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Describe various O-O concepts along with their applicability contexts.	H											

CO2	Identify domain objects, their properties, and relationships among them.		H										
CO3	Model/ represent domain constraints on the objects and (or) on their relationships.		H										
CO4	Develop design solutions for problems on various O-O concepts.			H									
CO5	Develop the communication skill by presenting topics on object-oriented software engineering.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Understand where to appropriately apply different concepts basing on different context through a strong level of knowledge on various O-O concepts.
CO2-POb	High	Design and conduct experiments by identifying relevant data objects of different domains, their attributes and different associations among them.
CO3-POb	High	Derive a model or representation for a solution by specifying and interpreting certain constraints on data objects and their relationships.
CO4-POc	High	Design and develop different solutions basing on the desired requirements through a detailed knowledge on various O-O concepts and their applicability.
CO5-POj	Low	Develop communication skills through participating presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Object-oriented approach Object-oriented approach (Contd.) Object-oriented approach (Contd.)	Class Test 1
2	Lec 4 Lec 5 Lec 6	Basic (procedural) elements of language Basic (procedural) elements of language (Contd.) Basic (procedural) elements of language (Contd.)	

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 Modularity (Contd.)	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 Environment matters: system configuration (Contd.) Environment matters: system configuration (Contd.)	
7	Lec 19 Lec 20 Lec 21	Interfacing with external software Garbage collection Garbage collection (Contd.)	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Advanced issues involving exception handling Advanced issues involving exception handling (Contd.) Advanced issues involving exception handling (Contd.)	
9	Lec 25 Lec 26 Lec 27	Repeated inheritance Typing problems Typing problems (Contd.)	
10	Lec 28 Lec 29 Lec 30	Parallelism O-O software engineering process O-O software engineering process (Contd.)	
11	Lec 31 Lec 32 Lec 33	OOAD to a maintainable Addresses verification OOAD to a maintainable Addresses verification (Contd.) OOAD to a maintainable Addresses verification (Contd.)	Class Test 3
12	Lec 34 Lec 35 Lec 36	OOAD to Address validation (V&V) Issues of Eiffel software systems Issues of Eiffel software systems (Contd.)	
13	Lec 37 Lec 38 Lec 39	Building reusable libraries Building reusable libraries (Contd.) Building reusable libraries (Contd.)	
14	Lec 40 Lec 41 Lec 42	The building of a parallel linear algebra library (Paladin) The building of a parallel linear algebra library (Paladin) (Contd.) The building of a parallel linear algebra library (Paladin) (Contd.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO3	C6
			CO4	C3, C6
	Class Participation	5%	CO5	A2
	Mid Term	10%	CO2	C1, C2, C4
	Attendance	5%		

Final Exam	60%	CO1	C1, C2
		CO2	C1, C2, C4
		CO3	C6
		CO4	C3, C6
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Object-Oriented Software Engineering (1st Edition) by Stephen Schach
2. Object Oriented Software Engineering: A Use Case Driven Approach (1st Edition) by Ivar Jacobson
3. Object-Oriented Software Engineering: Practical Software Development using UML and Java (2nd Edition) by Timothy Lethbridge and Robert Laganiere

REFERENCE SITE

CSE-432: Object Oriented Software Engineering Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-432 : Object Oriented Software Engineering Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs. in alternative week : 0.75

PRE-REQUISITE

Course Code: CSE - 205
Course Title: Object Oriented Programming Language

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Object-Oriented Software Engineering (OOSE) lab course is designed to focus on the practical application of object-oriented programming (OOP) principles and design patterns in software development. This course aims to bridge the gap between conceptual understanding and real-world software engineering practices, enabling students to gain hands-on experience in designing, developing and maintaining object-oriented systems.

OBJECTIVE

1. To develop proficiency in Object-Oriented Programming (OOP): Equip students with the skills to apply core OOP concepts—such as encapsulation, inheritance, polymorphism, and abstraction—in designing and developing robust, scalable, and maintainable software systems.
2. To master Software Design and Development Practices: Enable students to analyze software requirements, utilize design patterns effectively, and implement solutions using modern software engineering practices, with a focus on writing clean, efficient, and testable code.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Recall the fundamental concepts of object-oriented programming such as classes, objects,	C1, C2	1, 3, 7	1, 2, 3	2	V/Pr, R

	inheritance, encapsulation, polymorphism, and abstraction and explain the significance of design patterns and their applications in software development to solve common design problems.					
CO2	Apply object-oriented principles and design patterns in the development of software systems and analyze software requirements to effectively model the system's structure and behaviors.	C3, C4			3	ASG, Pr, Q
CO3	Evaluate and select appropriate design patterns for given software design problem and implement a comprehensive solution that demonstrates creativity and innovation in solving complex problems.	C6			5,6	PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; V-Viva; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Overview of object-oriented programming concepts, classes and objects, Methods, attributes, encapsulation, Inheritance and polymorphism, Abstract classes and interfaces, Exception handling mechanisms, debugging techniques in an OOP context, Collections and Data Structures, utilizing built-in collection frameworks, Basic data structures (lists, maps, sets) in OOP, Design Patterns, Software Modeling.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Recall the fundamental concepts of object-oriented programming such as classes, objects, inheritance, encapsulation, polymorphism, and abstraction and explain the significance of design patterns and their applications in software development to solve common design problems.	H											
CO2	Apply object-oriented principles and design patterns in the development of software systems and analyze software requirements to effectively model the system's structure and behaviors.		H										
CO3	Evaluate and select appropriate design patterns for given software design problem and implement a comprehensive solution that demonstrates creativity and innovation in solving complex problems.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Students will demonstrate proficiency in using object-oriented concepts such as encapsulation, inheritance, polymorphism, and abstraction to solve software engineering problems.
CO2-POb	High	Students will gain experience in analyzing software requirements, designing solutions using modeling tools and implementing those designs using an object-oriented programming language.

CO3-POc	High	Through group projects, students will design comprehensive solution that demonstrates creativity and innovation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab 1, 2	Setting up the IDE, writing a simple program to understand syntax and basic constructs, and introduction to Git for version control. Implement simple classes with attributes and methods. Practice creating objects and calling methods.	3:00 hrs in alternate week
3	Lab 3, 4	Create base classes and derived classes, override methods, and use virtual functions to achieve polymorphism. Design and implement abstract classes and interfaces, and understand their role in OOP.	
5	Lab 5, 6	Implement try-catch blocks, custom exceptions, and utilize logging frameworks. Use various collection classes and interfaces to store, retrieve, and manipulate objects.	
7	Lab 7, 8	Implement simple design patterns such as Singleton, Factory, and Strategy patterns. Implement structural and behavioral patterns such as Adapter, Observer, and Command patterns.	
9	Lab 9, 10	Project planning, requirements analysis, and design phase.	
11	Lab 11, 12	Implementation phase, focusing on applying OOP concepts, design patterns, and effective version control.	
13	Lab 13, 14	Finalization and Presentation	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Quiz	10%	CO2	C3, C4
	Report	10%	CO1	C1, C2
	Class	30%	CO2, CO3	C3, C4, C6

	Assessment			
	Viva/Presentation	10%	CO1	C1, C2
Mini project		40%	CO3	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1.Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides,
2. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development" by Craig Larman

REFERENCE SITE

CSE-433: Artificial Neural Networks and Fuzzy Systems

COURSE INFORMATION

Course Code Course Title	: CSE 433 : Artificial Neural Networks and Fuzzy Systems	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Artificial Neural Networks and Fuzzy Systems course is designed for 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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.	C1, C5	1, 3	1	1, 2, 3, 4	T, F
CO2	Explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.	C3, C4			1, 2, 3, 4	MT, F

CO3	Select and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.	C1-C3, A1			8	T, ASG, F
CO4	Develop the communication skill by presenting topics on artificial neural networks and fuzzy systems.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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. **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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.	H											
CO2	Explore the functional components of neural network classifiers or controllers, and the functional components of fuzzy logic classifiers or controllers.		H										
CO3	Select and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.				H								
CO4	Develop the communication skill by presenting topics on artificial neural networks and fuzzy systems.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Apply engineering knowledge to develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO2-POb	High	Explore the functional components of neural network classifiers or controllers we need to analyze, design and conduct experiments.

CO3-POd	High	Conduct investigations of complex problems to select and implement a basic trainable neural network or a fuzzy logic system for a typical control, computing application or biomedical application.
CO4-POj	Low	Develop strong communication skills through presentation on the selective topics from the course taught.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Biological nervous system: the 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	Theory and application of Artificial neural networks and 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 and counter propagation networks	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Higher order bi-directional associated memory, Lyapunov energy function	
9	Lec 25 Lec 26 Lec 27	Attraction basin, Probabilistic updates: simulated annealing, 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	Class Test 3
12	Lec 34 Lec 35 Lec 36	Logic control: adaptive fuzzy neural network	
13	Lec 37 Lec 38 Lec 39	Genetic algorithm and evolution compacting, Applications to control	
14	Lec 40 Lec 41 Lec 42	Pattern recognition; Nonlinear system modeling, Speech and image processing.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C5
			CO3	C1-C3
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C3, C4
	Attenance	5%		
Final Exam		60%	CO1	C1, C5
			CO2	C3, C4
			CO3	C1-C3, A1
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

CSE-434 Artificial Neural Networks and Fuzzy Systems Sessional

COURSE INFORMATION				
Course Code	:	CSE 434	Lecture Contact Hours	: 3.00 hrs in alternative week
Course Title	:	Artificial Neural Networks and Fuzzy Systems Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

RATIONALE
The Artificial Neural Networks and Fuzzy Systems Sessional is part of the Machine Learning course. It complements the theoretical understanding gained in the Artificial Neural Networks and Fuzzy Systems course by providing hands-on experience in implementing and experimenting with neural networks and fuzzy systems. It helps them understand how Artificial Neural Networks and Fuzzy Systems works, where models learn from new data and make decisions independently. Students learn to improve these models for better performance. By doing practical exercises and studying theory, students learn to solve real-world problems effectively.

OBJECTIVE
1.Implement and experiment with various types of neural networks discussed in the theory course. 2. Design and develop fuzzy logic systems for real-world applications. 3. Analyze and evaluate the performance of neural networks and fuzzy systems through practical experiments. 4. Gain proficiency in using relevant software tools for neural network and fuzzy system implementation

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the mathematical and statistical perspectives of Artificial Neural Networks and Fuzzy Systems through python programming.	C2, C3	1, 3, ,4	1, 3, 5	2,3	T, R, ASG
CO2	Design and evaluate fuzzy logic systems for solving real-world problems	C2, C3			5,6	R, ASG, Pr
CO3	Analyse and evaluate the performance of neural networks models and fuzzy systems.	C3, C4			5,6	R, ASG, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Implementation of Multi-layer Perceptron using software (e.g., TensorFlow, PyTorch) Designing and simulating Back Propagation Algorithm for training neural networks Implementation of Fuzzy Logic Controllers (FLCs) using MATLAB or Python libraries Experimenting with Radial Basis Function Networks (RBFNs) for pattern recognition tasks Developing Self-Organizing Maps (SOMs) for clustering applications Simulation of Adaptive Resonance Theory (ART) Networks for unsupervised learning Implementing Genetic Algorithms for optimization of neural network parameters Application of neural networks and fuzzy systems in control systems, pattern recognition, and image processing tasks

SKILL MAPPING													
No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the mathematical and statistical perspectives of Artificial Neural Networks and Fuzzy Systems through python programming.	H											
CO2	Design and evaluate fuzzy logic systems for solving real-world problems			H									
CO3	Analyze and evaluate the performance of neural networks models and fuzzy systems.				H								
(H – High, M- Medium, L-low)													

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Artificial Neural Networks and Fuzzy Systems enhance understanding of data analysis complexity, model selection, and machine learning fundamentals.
CO2-POc	High	Artificial Neural Networks and Fuzzy Systems empower students to identify suitable contemporary tools and algorithms, evaluating their pros and cons effectively.
CO3-POd	High	Able to appreciate the mathematical relationships and in-depth investigation and experimentation of the paradigms of various learning approaches.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning Revision	-
Assessment Preparations	-
Non-face-to-face learning Revision	-
Formal Assessment	
Continuous Assessment	02
Mid-Term Exam	-
Final Examination	03
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics

1-2	Lab -1, 2	Introduction to Lab Equipment and Software Tools, Implementation of Multi-layer Perceptron
3-4	Lab -3, 4	Designing Back Propagation Algorithm
5-6	Lab -5, 6	Implementing Fuzzy Logic Controllers, Experimenting with Radial Basis Function Networks
6-7	Lab-7,8	Developing Self-Organizing Maps, Simulation of Adaptive Resonance Theory Networks
8-9	Lab -9, 10	Implementing Genetic Algorithms, Application of Fuzzy Logic Systems in Image Processing
10-11	Lab -11, 12	Application of Neural Networks in Control Systems, Application of Neural Networks in Pattern Recognition
12-13	Lab -13, 14	Final Project and Presentation

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Reports and Assignments	40%	CO1	C2, C3
			CO2	C2, C3
	Lab Performance and Participation	10%	CO3	C3, C4
	Presentation	10%	CO2	C2, C3
Final Exam (Online Test + Quiz)		40%	CO1, CO3	C2, C3, C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

5. Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence and Robotics - Bart Kosko, Prentice Hall
6. Neural Networks: A Comprehensive Foundation, Simon Haykin, Prentice Hall
7. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press

REFERENCE SITE

CSE-435: Distributed Algorithms

COURSE INFORMATION

Course Code Course Title	: CSE-435 : Distributed Algorithms	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Distributed Algorithms course is designed to study of basic techniques in the design and development of Distributed Systems and understanding solutions of the fundamental problems in distributed systems. The course begins with different models of distributed computing and then covers essential concepts of distributed algorithms.

OBJECTIVE

1. To understand the limitations and fundamental concepts in the area of message passing and shared memory concurrency.
2. To apply the concepts to the example systems and algorithms.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the limitations and fundamental concepts in the area of message passing and shared memory concurrency	C1	1, 2, 3	1	1	T
CO2	Apply the concepts to the example systems and algorithms	C3			4	MT
CO3	Adapt and design algorithms for execution in parallel and distributed settings	C2, C3, C5			5	T, F
CO4	Analyse the algorithms for correctness, reliability, security and performance	C4			2	F
CO5	Be able to develop communication skill by presenting topics on distributed algorithms.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Models of distributed computing: Synchrony communication, Failure concerns, Synchronous message-passing; **Distributed systems**: Algorithms in systems with no failures-Leader Election, Breadth-First Search algorithms; **The atomic commit problem**: Consensus problems-the Byzantine Generals Problem; **Asynchronous message-passing of distributed systems**: Failure detectors I, Failure detectors II, **Logical time Vector clocks:** Routing algorithm

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the limitations and fundamental concepts in the area of message passing and shared memory concurrency	H											
CO2	Apply the concepts to the example systems and algorithms	H											
CO3	Adapt and design algorithms for execution in parallel and distributed settings			M									
CO4	Analyse the algorithms for correctness, reliability, security and performance		H										
CO5	Be able to develop communication skill by presenting topics on distributed algorithms.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POa	High	Increase the breadth and depth of knowledge by understanding the fundamental concepts in the area of message passing and shared memory concurrency
CO2-POa	High	Improve the breadth and depth of knowledge by applying the concepts to the example systems and algorithms
CO3-POc	Medium	Adapt and design algorithms for execution in parallel and distributed settings in which solutions have previously been identified and coded
CO4-POb	High	Improving the skill of problem analysis by analysing the algorithms for correctness, reliability, security and performance
CO5-POj	Low	Develop communication skills through participating in presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Models of distributed computing	Class Test 1
2	Lec 4 Lec 5 Lec 6	Synchrony communication	
3	Lec 7 Lec 8 Lec 9	Failure concerns	
4	Lec 10 Lec 11 Lec 12	Synchronous message-passing	Class Test 2
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	Mid Term Exam

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 3
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	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO3	C2, C3, C5
	Class Participation	5%	CO5	A2
	Mid term	10%	CO2	C3
	Attendance	5%	-	-
Final Exam		60%	CO3	C2, C3, C5
			CO4	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Distributed Systems - S. Mullender (ed.), Addison-Wesley
2. Introduction to Distributed Algorithms - G. Tel. Cambridge Univ. Press

REFERENCE SITE

CSE-436: Distributed Algorithms Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-436 : Distributed Algorithms Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Distributed Algorithms Sessional course is designed to design, development, implement and analysis of Distributed Systems and understanding solutions of the fundamental problems in distributed systems. The course begins with different models of distributed computing and then covers essential concepts of distributed algorithms.

OBJECTIVE

1.To understand the limitations and fundamental concepts in the area of message passing and shared memory concurrency.
2.To apply the concepts to the example systems and algorithms.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Finding the limitations and fundamental concepts in the area of message passing and shared memory concurrency	C1	1, 2, 3	1	1	Q, ASG
CO2	Apply the concepts to the example systems and algorithms	C3			4	T, Q, ASG
CO3	Adapt and design algorithms for execution in parallel and distributed settings	C2, C3, C5			5	T, Q
CO4	Implement and analyse the algorithms for correctness, reliability, security and performance	C4, A2			2	Pr
CO5	Be able to develop communication skill by presenting topics on distributed algorithms.	A2				Q, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Models of distributed computing: Synchrony communication, Failure concerns, Synchronous message-passing; **Distributed systems**: Algorithms in systems with no failures-Leader Election, Breadth-First Search algorithms; **The atomic commit problem**: Consensus problems-the Byzantine Generals Problem; **Asynchronous message-passing of distributed systems**: Failure detectors I, Failure detectors II, **Logical time Vector clocks:** Routing algorithm

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the limitations and fundamental concepts in the area of message passing and shared memory concurrency	H											
CO2	Apply the concepts to the example systems and algorithms	H											

CO3	Adapt and design and implement algorithms for execution in parallel and distributed settings			M									
CO4	Analyse the algorithms for correctness, reliability, security and performance		H										
CO5	Be able to develop communication skill by presenting topics on distributed algorithms.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Increase the breadth and depth of knowledge by understanding the fundamental concepts in the area of message passing and shared memory concurrency
CO2-POa	High	Apply the breadth and depth of knowledge concepts to the real time example systems and algorithms
CO3-POc	Medium	Adapt, design and implement algorithms for execution in parallel and distributed settings in which solutions have previously been identified and coded
CO4-POb	High	Improving the skill of problem analysis by analysing the implemented algorithms for correctness, reliability, security and performance
CO5-POj	Low	Develop communication skills through participating in presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - _ _
Formal Assessment Continuous Assessment Final Examination	 3 1
Total	25

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Evaluation/ Assessment
1-2	Lab 1 Lab 2	Models of distributed computing Synchrony communication	Class Performance, Assignment
3-4	Lab 3 Lab 4	**Implementation and analysis:** Failure concerns Synchronous message-passing	Class Performance, Assignment, Report
5-6	Lab 5 Lab 6	**Implementation and analysis:** Distributed systems Algorithms in systems with no failures - Leader Election	Class Performance, Quiz

7-8	Lab 7 Lab 8	**Implementation and analysis:** Breadth-First Search algorithms The atomic commit problem	Class Performance, Report
8-9	Lab 9 Lab 10	**Implementation and analysis:** Consensus problems - the Byzantine Generals Problem Asynchronous message-passing of distributed systems	Class Performance, Assignment, Report
10-11	Lab 11 Lab 12	**Implementation and analysis:** Failure detectors I Failure detectors II	Class Performance, Assignment, Quiz
12-13	Lab 13 Lab 14	**Implementation and analysis:** Routing algorithms Logical time Vector clocks	Class Performance, Quiz, Assignment, Report

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	C1
			CO4	C4, A2
	Class Participation	5%	CO2	C3
	Assignment/Presentation	15%	CO2/CO5	C3/ A2
Online Test – 1		20%	CO1	C1
Online Test – 2		20%	CO3	C2, C3, C5
Viva/ Quiz		20%	CO2, CO3	C3, C2, C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Distributed Systems - S. Mullender (ed.), Addison-Wesley
2. Introduction to Distributed Algorithms - G. Tel. Cambridge Univ. Press

REFERENCE SITE

CSE-437: Bioinformatics

COURSE INFORMATION

Course Code Course Title	: CSE-437 : Bioinformatics	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to introduce bioinformatics at a level appropriate for computer science majors having an interest in computational biology. The main course includes (but not limited to) bioinformatics databases, phylogenetics, protein structure prediction, multiple sequence alignment, genome assembly, application of machine learning in computational biology, security and privacy for genomic data, etc.

OBJECTIVE
1. To familiarize with vast amounts of biomedical and genomic data and the use of computational power of analyze those data. 2. To impart a solid understanding of the field of bioinformatics sequence analysis, phylogenetics, protein structure prediction, different topics of molecular biology and their application in medical science. 3. To familiarize with the application of machine learning in computational biology, security and privacy for genomic data etc.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Account for and use of biomedical and genomic data as well as the use of computational power to analyze those data.	C1, C2	1, 2,3	1, 2	3	T, F
CO2	Percept methods in sequence bioinformatics such as sequence alignment, phylogenetic analysis and pattern recognition.	C4, P1			2	T, Mid Term Exam, F
CO3	Analyze and compile results of bioinformatic analyses, such as protein structure prediction, molecular biology etc.	C4, C5			4	T, Mid Term Exam, F
CO4	Solve given biological problems by using appropriate bioinformatic methods and databases.	P1, C6			5	PR, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to Bioinformatics: The central dogma of biology: DNA, RNA, **Sequence alignment:** Genomic sequences, Scoring matrices. Pairwise alignment. **Online databases**: BLAST, Advanced BLAST, **Molecular phylogeny**: Sequence alignment with dot matrix, Alignment visualization, Optimal alignment using dynamic programming method, Analyzing and sequencing nucleic acids, **Structure and hierarchy of proteins**: Principles of protein structure, protein secondary structure prediction, Protein tertiary structure prediction, **Introduction to phylogenetics:** drawing tree diagrams, tree building methods, **Constructing phylogenetics tree**: Stepwise clustering, Fitch Margoliash method, Maximum parsimony and maximum likelihood method, Ancestral studies using phylogeny, **DNA replication**: transcription, translation, Multiple sequence alignment, **DNA digital data storage:** DNA-based Archival Storage System. **Human variation and disease**: Sequence variation, phenologs, comparative genomics, and Personalized medicine.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Account for and use of biomedical and genomic data as well as the use of computational power to analyze those data.				H								
CO2	Percept methods in sequence bioinformatics such as sequence alignment, phylogenetic analysis and pattern recognition.	H											
CO3	Analyze and compile results of bioinformatic analyses, such as protein structure prediction, molecular biology etc.		H										

CO4	Solve given biological problems by using appropriate bioinformatic methods and databases.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POd	High	In-depth investigation and experimentation can be done by figure out medical data and by perceiving the use of computational power to understand them.
CO2-POa	High	In-depth engineering knowledge can be perceived through understanding different bioinformatics algorithm, e.g., sequence alignment, phylogenetic analysis and pattern recognition.
CO3-POc	High	Complexity of an engineering problem can be realized by inspecting results of bioinformatics algorithms.
CO4-POc	High	The skill on designing and developing engineering solutions could be developed by solving given biological problems by using appropriate bioinformatic methods and databases.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Bioinformatics: What and why? The central dogma of biology: DNA, RNA	Class Test-1
2	Lec 4 Lec 5 Lec 6	Intro to sequence alignment. Genomic sequences, Scoring Matrices.	
3	Lec 7 Lec 8 Lec 9	Online database, database searching, BLAST, Advance BLAST, PSI-BLAST	Mid Term Exam
4	Lec 10 Lec 11 Lec 12	Molecular phylogeny introduction, molecular phylogeny and evolution	

5	Lec 13 Lec 14 Lec 15	Pairwise alignment, Sequence alignment with dot matrix, Alignment visualization with dot matrix tools.	
6	Lec 16 Lec 17 Lec 18	Optimal alignment, optimal alignment using dynamic programming method	
7	Lec 19 Lec 20 Lec 21	Analyzing and sequencing nucleic acids, Structure and hierarchy of proteins, Proteomics and genomics in bioinformatics	
8	Lec 22 Lec 23 Lec 24	Principles of protein structure, protein secondary structure prediction, protein tertiary structure prediction	Class Test-2
9	Lec 25 Lec 26 Lec 27	Introduction to phylogenetics, drawing tree diagrams, tree building methods	
10	Lec 28 Lec 29 Lec 30	Constructing phylogenetics tree: Stepwise clustering, Fitch Margoliash method	
11	Lec 31 Lec 32 Lec 33	Constructing phylogenetics tree: Maximum parsimony and maximum likelihood method, Ancestral studies using phylogeny	Class Test-3
12	Lec 34 Lec 35 Lec 36	DNA replication, transcription, translation, Multiple sequence alignment.	
13	Lec 37 Lec 38 Lec 39	DNA digital data storage, DNA-based Archival Storage System.	
14	Lec 40 Lec 41 Lec 42	Human variation and disease. Sequence variation, phenologs, comparative genomics. Personalized medicine.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO3	C4, C5
	Class Performance/Project	5%	CO4	C6, P1
	Mid term	10%	CO2	C4, P1
	Attendance	5%	-	-
Final Exam		60%	CO1	C1, C2
			CO2	C4, P1
			CO3	C4, C5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Understanding bioinformatics (1st Edition) by Zvelebil, Marketa J; Baum, Jeremy O
2. Bioinformatics and Functional Genomics (2nd edition) by Jonathan Pevsner

REFERENCE SITE

CSE-438: Bioinformatics Sessional

COURSE INFORMATION				
Course Code	:	CSE 438	Lecture Contact Hours	: 3.00 hrs in alternative week
Course Title	:	Bioinformatics Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course gives a comprehensive understanding and practical skills in bioinformatics. It covers fundamental concepts such as sequence analysis, molecular modeling, and data mining techniques essential for analyzing biological data.
OBJECTIVE
5. To Comprehend essential principles of bioinformatics, encompassing the analysis of genetic sequences, modeling molecular structures, and employing data mining methodologies. 6. To understand the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand fundamental concepts in bioinformatics, including sequence analysis, molecular modeling, and data mining techniques.	C2, C3	1, 2, 6	1, 2, 4	6	T, Q
CO2	Develop proficiency in utilizing bioinformatics tools and software for analyzing genetic sequences, protein structures, and biological data.	C2, C3			8	ASG, T
CO3	Apply bioinformatics methodologies to solve practical biological problems, interpret genomic data, and contribute to advancements in biomedical research.	C3, C4			2	R, Q, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Definition and scope of bioinformatics Introduce bioPython Basics of DNA, RNA, and protein sequences Sequence alignment algorithms (e.g., BLAST, Smith-Waterman) Hands-on practice with sequence alignment tools Principles of molecular structure determination Introduction to molecular modeling software (e.g., PyMOL, Swiss-Model) Hands-on session on predicting protein structures Principles of molecular structure determination Introduction to molecular modeling software (e.g., PyMOL, Swiss-Model) Hands-on session on predicting protein structures Overview of data mining methods in bioinformatics Introduction to machine learning algorithms for biological data analysis Hands-on exercises on data mining using Python Phylogenetic tree construction and analysing using python (Biopython or scikit-bio), Solving UPGMA, NJ and small parsimony problems.

SKILL MAPPING													
No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand fundamental concepts in bioinformatics, including sequence analysis, molecular modeling, and data mining techniques.	H											
CO2	Develop proficiency in utilizing bioinformatics tools and software for analyzing genetic sequences, protein structures, and biological data.		H										
CO3	Apply bioinformatics methodologies to solve practical biological problems, interpret genomic data, and contribute to advancements in biomedical research.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Able to understand fundamental concepts in bioinformatics
CO2-POb	High	Able to utilize bioinformatics tools and software for analyzing genetic sequences, protein structures, and biological data
CO3-POc	High	Able to examine practical biological problems, interpret genomic data, and contribute to advancements in biomedical research.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 02 - 03
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week	**Lecture**	**Topics**
1-2	Lab -1, 2	Definition and scope of bioinformatics introduce bioPython
3-4	Lab -3, 4	Basics of DNA, RNA, and protein sequences Sequence alignment algorithms (e.g., BLAST, Smith-Waterman) Hands-on practice with sequence alignment tools
5-6	Lab -5, 6	Principles of molecular structure determination Introduction to molecular modeling software (e.g., PyMOL, Swiss-Model) Hands-on session on predicting protein structures
6-7	Lab-7,8	Overview of data mining methods in bioinformatics Introduction to machine learning algorithms for biological data analysis
8-9	Lab -9, 10	Hands-on exercises on data mining using Python
10-11	Lab -11, 12	Phylogenetic tree construction and analyzing using python (Biopython or scikit-bio)
12-13	Lab -13, 14	Solving UPGMA, NJ and small parsimony problems.

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5
	Class Participation	10%	CO3	C4, A2, A1
	Presentation	10%	CO2	C6, A4, P3
Final Exam (Online Test + Quiz)		40%	CO1, CO3	C2-C6, P1
			CO3	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

3. "Bioinformatics Programming Using Python: Practical Programming for Biological Data" by Mitchell L. Model**:**
4. "Biopython Tutorial and Cookbook" by Jeff Chang, Brad Chapman, Iddo Friedberg, Thomas Hamelryck, Michiel de Hoon, and Peter Cock**:**

REFERENCE SITE

CSE-439: Robotics

COURSE INFORMATION			
Course Code Course Title	: CSE-439 : Robotics	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)
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 analyse the simulation, modelling and drawbacks of a robotic system for an interactive complex environment.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Explain with the concept development and key components of robotics technologies.	C1, C2, P1, A1	1 2, 3, 5	1 3, 5	1, 2	T
CO2	Solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.	C4, A2, A4, P5, P6			3, 4	F, T
CO3	Design and implement a robotic project on a physical mobile robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modelling, control and obstacle avoidance in a complex and interactive environment.	C3, C4, C6, P3, P7, A4, A5			5, 6	MT, PR, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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 modelling; **Human-machine interface**: embedded software mechanical design, rigid body velocity, Jacobean, inverse kinematics, redundant and parallel robots, trajectory control, face control and haptics, **Micro and Nano-robotics**: mobile robots. Human-robot interaction, Multiagents, fault diagnosis.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Explain with the concept development and key components of robotics technologies.	H											
CO2	Solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control, localization and mapping, navigation and path planning.		H										
CO3	Design and implement a robotic project on a physical mobile			H									

	robot platform, with tasks involving project specification, algorithm design, software programming, simulation and modelling, control and obstacle avoidance in a complex and interactive environment.												

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Understand the breadth and depth of different concept development and key components of robotics technologies.
CO2-POb	High	Analyse complex robotics problems and understand the ways to solve them.
CO3-POc	High	Design and solve unique engineering problems by implementing a robotic project on a physical mobile robot platform.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Mid-Term Exam	1
Final Examination	3
Total	132

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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 Lec 21	Manipulator Dynamics Trajectory Generation Multi-rigid body Dynamics	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Linear Control of manipulators Non-Linear Control Manipulators Force Control of Manipulators	
9	Lec 25 Lec 26 Lec 27	3D Graphic Simulation 3D Graphic Simulation (Contd.) 3D Graphic Simulation (Contd.)	
10	Lec 28 Lec 29 Lec 30	Control Design Actuators Sensors	
11	Lec 31 Lec 32 Lec 33	Task Modelling, 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	

ASSESSMENT STRATEGY

<table>
<tr><td colspan="3"></td><td rowspan="2">CO</td><td rowspan="2">Blooms Taxonomy</td></tr>
<tr><td colspan="2">Components</td><td>Grading</td></tr>
<tr><td rowspan="5">Continuous Assessment (40%)</td><td rowspan="2">Test 1-3</td><td rowspan="2">20%</td><td>CO1</td><td>C1, C2</td></tr>
<tr><td>CO2</td><td>C3, C4</td></tr>
<tr><td>Class Participation</td><td>5%</td><td>CO3</td><td>A2</td></tr>
<tr><td>Mid term</td><td>10%</td><td>CO2</td><td>C4, P6</td></tr>
<tr><td>Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="2">Final Exam</td><td rowspan="2">60%</td><td>CO1, CO3</td><td>C1-C4, C6</td></tr>
<tr><td>CO2</td><td>P3, A4</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introduction to Robotics: Analysis, Control, Applications (6th Edition) - Saeed B. Niku; Wiley (2019)
2. Introduction to Robotics: Mechanics and Control (3rd Edition) - John J. Craig; Pearson (2015)

REFERENCE SITE

CSE-440: Robotics Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE 440 : Robotics Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Robotics Sessional course is structured to orient different mechanism of robot motion, kinematics, dynamics, control engineering, sensors & actuators, and intelligent behaviour. Through this course, students will be in closer look at Overview of robots, Introduction to Robotics engineering, Robot kinematics, Robot Dynamics, Trajectory planning, Sensing systems and actuators, Introduction to Control Engineering, Robot vision, Robot programming and interfacing, Fundamental of robot design and testing, and Applications of robots. This course will also help to understand the fundamental problems in path planning, trajectory tracking, multi-robot cooperation, Sensor-based planning, and Active perception.

OBJECTIVE

1. To study and learn mathematical modelling of various robotic system and their position and motion behaviour.
2. To design, implement, and analyse various robotic systems through simulation and practical experimentaiton.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to achieve the following.)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the mathematical, mechanical, electronics, and control prospective of robotics.	C1-C6, P1, P6	1, 2, 6, 3, 7,	1, 2, 4, 3	6	T, Q
CO2	Design and evaluate the robot dynamic models through programming implementation	C3, C6, A4, A5, P6			8	ASG, T
CO3	Evaluate the designed robot models through robot resultant behaviour and signal output analysis.	C2 – C6 P1, A1, A2			2	R, Q, Pr
CO4	Design *and* develop suitable robots and its practical implementations	P3, A4, C3, C4, C6			5	T, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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 modelling; **Human-machine interface:** embedded software mechanical design, rigid body velocity, Jacobean, inverse kinematics, redundant and parallel robots, trajectory control, face control and haptics, **Micro and Nano-robotics:** mobile robots. Human-robot interaction, Multiagents, fault diagnosis.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the mathematical, mechanical, electronics, and control prospective of robotics.		H										
CO2	Design and evaluate the robot dynamic models through programming implementation			H									
CO3	Evaluate the designed robot models through robot resultant behaviour and signal output analysis.				H								
CO4	Design and develop suitable robots and its practical implementations							H					

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POb	High	Able to understand the complexity in analysis of system.
CO2-POc	High	Capable of determining which contemporary tools or learning algorithms are appropriate.
CO3-POd	High	Able to appreciate the mathematical relationships and in-depth investigation and experimentation of the paradigms of robotic systems.
CO4-POg	High	Able to design and implement robots for society automation.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 2 - 3
Total	26

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab -1, 2	Robot dynamic modelling and simulation (Position control)	3.00 in alternate week
3	Lab -3, 4	Robot dynamic modelling and simulation (Velocity and speed control)	

5	Lab -5, 6	Forward and inverse kinematics	
7	Lab -7, 8	Component selections and relevant mathematical calculations and implementations	
9	Lab -9, 10	Path planning and optimal path finding strategies with practical implementation	
11	Lab -11, 12	Trajectory tracking experimentation	
13	Lab -13, 14	Robot intelligent behaviour modelling, implementation, and testing	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5
	Class Participation	10%	CO3	C4, A2, A1
	Presentation	10%	CO2	C6, A4, P3
Final Exam (Online Test + Quiz)		40%	CO1, CO3	C2-C6, P1
			CO4	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, 2nd Edition, John Wiley & Sons, 2019.
2. R. K. Mittal, I. J. Nagrath. Robotics and Control. Tata McGraw-Hill, 2003.
3. Hooman Samani, Cognitive Robotics, CRC press, Taylor & Francis Group, October 16, 2015, SBN 9781482244564 - CAT# K23493.

REFERENCE SITE

CSE-447: Telecommunication Engineering

COURSE INFORMATION

Course Code Course Title	: CSE 447 : Telecommunication Engineering	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)
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 develop knowledge on design and management of various telecommunication system. 3. To develop skill on identification of telecommunication problems solving the respective problems. 4. To acquire the knowledge and expertise in the field of telecommunication hardware.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate theoretical and technical knowledge of telecommunications systems associated with LANs, MANs, and WANs.	C2, P1	1, 2, 3	1, 2, 3	1	T, F
CO2	Learn to design, implement, and manage telecommunications systems using voice and data.	C6			1, 3	Q,MT,F
CO3	Model and simulate telecommunications systems and networks in order to identify and solve these problems	P6			5	ASG
CO4	Acquire the knowledge and expertise in the field of telecommunication hardware	C3, A2			5	Q, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate theoretical and technical knowledge of telecommunications systems associated with LANs, MANs, and	H											

	WANs.												
CO2	Learn to design, implement, and manage telecommunications systems using voice and data			M									
CO3	Model and simulate telecommunications systems and networks in order to identify and solve these problems			H									
CO4	Acquire the knowledge and expertise in the field of telecommunication hardware					M							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Understanding the theoretical and technical will highly increase the breadth and depth of knowledge
CO2-POc	Medium	Designing, implementation and managing telecommunications systems help to understand the breadth and uniqueness of engineering problem to the extent to which problems are original and to which solutions have previously been identified and coded
CO3-POc	High	Identifying and solving the problems of telecommunications systems and networks enhance breadth & uniqueness of engineering problems
CO4-POe	Medium	Knowledge and expertise in the field of telecommunication hardware enable understanding of the appropriateness of the tool

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assignment Preparations	 42 21 21
Formal Assessment Continuous Assessment Quiz/ test Mid-Term Final Examination	 2 3 1 3
Total	132

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction: Overview of Telecommunication History of Telecommunication Evolution of Telecommunication	Class Test 1
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.)	

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	Class Test 2
5	Lec 13 Lec 14 Lec 15	Advanced Systems of Power Supplies Transmission Media Characteristics and Applications: Twisted Pairs	
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	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	PSTN, PBX Standards Modulation Multiplexing	
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	Class Test 3
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	
14	Lec 40 Lec 41 Lec 42	Optical Fibre Communication Submarine Cables Digital radio Microwave	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1, C2
			CO 2	C3, C4
	Class Participation	5%	CO3, CO4	A2
	Mid term	10%	CO 2	C2
	Attendance	5%	-	-
Final Exam		60%	CO 1, CO 2, CO 4	C2, C3, C4, A2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)
REFERENCE SITE

TECHNICAL ELECTIVE – II

CSE-411: VLSI Design

COURSE INFORMATION			
Course Code Course Title	: CSE-411 : VLSI Design	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course is designed to enhance students' understanding of the theory and fundamentals of silicon fabrication, the design principles and logical considerations of designing silicon chips, and finally, to develop an understanding of design considerations and the overall process of VLSI systems and their fabrication. This course is also intended to enable students to contribute to VLSI system designing and to have a better understanding of the 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, behavior, and performance metrics of different integrated digital electronic circuits. 3. To understand the various stages involved in designing a silicon chip, ranging from the initial system and logical considerations to designing each layer of silicon and finally, overall fabrication process.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of this course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Describe mathematical methods and circuit analysis models in the analysis of CMOS digital electronics circuits, including logic components and their interconnections	C1, C2, A1, A2	1, 2 3, 7	1, 2, 3, 5	2, 3	MT, T, F
CO2	Understand and analyze models of moderately sized CMOS circuits to implement specified digital functions.	C1-C4, C6, A2, P1-P2			2-4	MT, T, F
CO3	Understand and apply the basic theory of MOS devices and basic circuits, the overall process of designing MOS circuits, and the VLSI fabrication process on an industrial scale.	C1, C2, C6 A1-A3			3, 4	MT, F
CO4	Design MOS circuits to achieve various basic to moderately complex digital functions using VLSI design rules and geometric or stick diagrams.	C3-C6, A4, A5 P1, P2			4, 5	MT, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

VLSI design methodology: Top-down Design Approach, Technology Trends and Design Automation Algorithms; **Introduction to CMOS Inverters** and Basic Gates; MOS devices and Basic Circuits (various inverters, pass gates and buffer circuits), **CMOS Fabrication Process** and Layout; CMOS Circuit Characteristics and Performance Estimation; **Buffer Circuit Design**; Introduction to **BiCMOS 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; **Geometric and stick diagrams**, 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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)										
		a	b	c	d	e	f	g	h	i	j	k
CO1	Describe mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnections	H										
CO2	Understand and analyze models of moderately sized CMOS circuits to implement specified digital functions.		H									
CO3	Understand and apply the basic theory of MOS devices and basic circuits, the overall process of designing MOS circuits, and the VLSI fabrication process on an industrial scale.			H								
CO4	Design MOS circuits to achieve various basic to moderately complex digital functions using VLSI design rules and geometric or stick diagrams.				H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	The student would acquire engineering knowledge of the fundamental circuits, their analysis, logical and mathematical characteristics and how these concepts are used for VLSI fabrication. Understanding the models and internal workings of basic CMOS circuits will help in acquiring fundamental knowledge on VLSI circuits.
CO2-POb	High	Understanding the models and internal workings of basic CMOS circuits will also help in developing the design considerations and solution formulation for a given digital function to be solved by a VLSI circuit. The student will also get an idea on the logical and design considerations for designing a system on chip and how to compare between them to get desired output.

CO3-POc	High	Understanding the basic theory of MOS devices and basic circuits, the overall process of designing MOS circuits, and the VLSI fabrication process will provide the students with basic knowledge of VLSI design. The students will also learn about the modern fabrication process and the various tool and techniques used in modern VLSI fabrication. While understanding the silicon fabrication process on an industrial scale, the student will also learn about the design considerations to ensure minimized health, safety hazards and making a lean and efficient fabrication process.
CO4-POd	High	The students will also learn about the best use of silicon and other resources in the VLSI fabrication process while considering it's environmental impact. The VLSI design process requires the analytical ability of students in coming up with logical designs for the various VLSI designs. The students would need to apply their knowledge of basic CMOS circuits and gates to design various basic to moderately complex VLSI systems. The students will also develop the skill to work as an individual in engineering design problems such the VLSI system design. While designing the systems, students will, in hindsight, also develop an idea on how to come up with various design solutions based on the materials, equipments and other modern tools available.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 1 1 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1-3	Introduction to VLSI design diodes, BJTs and MOSFETs, NMOS and CMOS	Class Test 1
2	Lec 4 -6	Internal Structure of MOSFETs Hierarchical Design Inverter Principles	
3	Lec 7-9	Threshold Voltage Ids Calculation for Saturation Region Ids Calculation for Resistive Region	

4	Lec 10-12	Characteristics Curves Characteristics Curves (Contd.) NMOS Inverter with Resistive Load	Class Test 2
5	Lec 13-15	NMOS Inverter with Enhancement Load Inverter Ratio for NMOS Inverter with Enhancement Load Problems with Enhancement Transistor	
6	Lec 16-18	NMOS Inverter with Depletion Load Rise Time Calculation Fall Time Calculation	
7	Lec 19-21	CMOS Characteristics Curve CMOS Power and Transfer Curve Pass Transistor Principles	
8	Lec 22-24	Pass Transistor NMOS Ratioless NMOS Inverter CMOS Pulse Gate	Class Test 3
9	Lec 25-27	Buffer Circuits Buffer Chain Super Buffer	
10	Lec 28-30	Power Dissipation Static Power Dissipation Dynamic Power Dissipation	
11	Lec 31-33	Short Circuit Power Dissipation CMOS Noise Margin CMOS Noise Margin (Contd.)	Mid Term Exam / Project
12	Lec 34-36	NMOS Noise Margin NMOS NAND and NOR Gates CMOS NAND and NOR Gates	
13	Lec 37-39	Stick Diagrams Design Rules of Geometric Layout Circuit Design using Stick Diagrams and Geometric Layout	
14	Lec 40-42	n-well Formation Oxide Layer Formation Cross Section of CMOS	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2, A1, A2
			CO3	C1, C2, C6, A1-A3
			CO4	C3-C6
	Class Participation	5%	CO1	A1, A2
	Mid term	10%	CO2-CO4	C1-C6, A1-A3, P1-P2
	Attendance	5%		
Final Exam		60%	CO1	C1, C2, A1, A2
			CO2	C1-C4, C6, A2, P1-P2
			CO3	C1, C2, C6 A1-A3
			CO4	C3-C6, A4, A5, P1, P2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Design of VLSI Systems - A Practical Introduction - Linda E.M. Brackenbury
2. Modern VLSI Design: System-on-Chip Design (3rd Edition) - Wayne Wolf; Prentice Hall (2002)

3. CMOS VLSI Design- A Circuit and System Perspective (3rd Edition) - Neil H.E. Weste, David Harris and Ayan Banerjee; Pearson (2009)
REFERENCE SITE

CSE-412: VLSI Design Sessional

COURSE INFORMATION				
Course Code	:	CSE 412	Lecture Contact Hours	: 3.00 hrs in alternative week
Course Title	:	VLSI Design Sessional	Credit Hours	: 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course is designed to be offered alongside CSE 411 so that students may acquire a better understanding of VLSI and CMOS circuit design principles, logical and mathematical considerations, the overall design process, and the silicon fabrication process using various modern tools, ICs, and simulators.
OBJECTIVE
1. To achieve basic knowledge of VLSI system design principles, design considerations, and the design process. 2. To analyze and solve various given digital function problems using the concepts of VLSI and CMOS systems. 3. To design the solutions developed by the students using ICs and simulators to get a practical understanding of the VLSI system design process.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Acquire fundamental knowledge and understating of VLSI systems, their design principles, design considerations, and the overall design process using simulation and design software.	C1, C2, A1, A2, P1, P2	-	1, 2, 3	1, 3	T, Q
CO2	Analyze a given digital function or a given circuit problem to implement and evaluate a VLSI system or CMOS circuit.	C3, C4, C6, A5			2, 5	T, Q, ASG
CO3	Design and implement the solutions developed by the students for particular problems using ICs and simulator software.	C3-C6, A5-A5, P2			5, 6	T, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT
Introduction: Various simulator software for electronic system design **(PSpice, DSCH and Microwind)**, implementing basic electrical circuits with PSpice, design, and implementation of **logic gates and inverter circuits** (inverter, AND, OR, NAND, NOR), comparing the **I/O and electrical characteristics graphs** of logic gates with various simulator software, Designing **basic electrical circuits** (inverters, AND, OR, NAND, NOR) with microwind and comparing the I/O and electrical characteristic graphs with PSpice, DSCH and Microwind.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Acquire fundamental knowledge and understating of VLSI systems, their design principles, design considerations, and the overall design process using simulation and design software.	H											
CO2	Analyze a given digital function or a given circuit problem to implement and evaluate a VLSI system or CMOS circuit.			H									
CO3	Design and implement the solutions developed by the students for particular problems using ICs and simulator software.				H								

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Use of simulators to get practical understanding of various CMOS and VLSI systems will help students to strengthen their fundamental theoretical knowledge of VLSI systems. Various simulator software will help students to use modern tools, techniques and software in designing and evaluating various CMOS circuits and systems. Students will have to analyze the given digital function and design a solution for that using CMOS circuits.
CO2-POc	High	As per their analysis, students will have to design and implement VLSI systems to implement a given digital function or to achieve a specific set of digital outcomes. While coming up with the design, students will also get to apply their theoretical knowledge of sustainability, environmental impact and cost-efficiency of certain resources needed for a particular chip/system fabrication.
CO3-POd	High	While implementing their solutions in simulators, students will get a better understanding of their VLSI system design and its various considerations. Students will be using various latest simulator software for implementing their designs and to test the characteristics of basic designs of various CMOS circuits.

		While making logical and mathematical design choices for their VLSI systems and CMOS circuits, students will get to learn how to function as an individual member of a design and implementation team. Through the overall design process, students will also get an overall understanding of the VLSI system and its fabrication process, resulting in an ability to use this intuition in designing such systems in future, on an industrial setting.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations Non-face-to-face learning Revision	 - - -
Formal Assessment Continuous Assessment Final Examination	 02 03
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics
1-2	Lab 1 Lab 2	Introduction to PSpice, Design and implement some basic electrical circuits with PSpice
3-4	Lab 3 Lab 4	Design and implement logic gates (inverter, AND, OR, NAND, NOR) with PSpice
5-6	Lab 5 Lab 6	Design and implement logic gates (AND, OR, NAND, NOR) and their I/O graphs with PSpice and DSCH and compare the results
6-7	Lab 7 Lab 8	Design and implement logic gates (various types of inverters and buffer circuits) and their I/O graphs with PSpice and DSCH and compare the results
8-9	Lab 9 Lab 10	Design and implement some basic electrical circuits with Microwind
10-11	Lab 11 Lab 12	Design and implement inverter, AND, OR, NAND, NOR with Microwind
12-13	Lab 13 Lab 14	Design and implement logic gates and their I/O graphs with PSpice, DSCH and Microwind and compare the results

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	ASG/Class Evaluations	30%	CO2	C3, C4, C6, A5
			CO3	C3-C6, A5-A5, P2
	Class Participation	5%	CO1	C1, C2, A1,

				A2, P1, P2
			CO2	C3, C4, C6, A5
	Quiz	15%	CO1	C1, C2, A1, A2, P1, P2
Tests (Online 1 and 2)		50%	CO2	C3, C4, C6, A5
			CO3	C3-C6, A5-A5, P2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Design of VLSI Systems - A Practical Introduction - Linda E.M. Brackenbury
2. Modern 1. Modern VLSI Design: System-on-Chip Design (3rd Edition) - Wayne Wolf; Prentice Hall (2002)

REFERENCE SITE

CSE-441: Machine Learning

COURSE INFORMATION

Course Code Course Title	: CSE-441 : Machine Learning	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Machine Learning course provides a broad introduction to machine learning and statistical pattern recognition. Topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, neural networks, support vector machines); unsupervised learning (clustering, dimensionality reduction, kernel methods); learning theory (bias/variance tradeoffs, practical advice); reinforcement learning and adaptive control. The course will also discuss recent applications of machine learning, such as to robotic control, data mining, autonomous navigation, bioinformatics, speech recognition, and text and web data processing.

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 proper usage of learning parameters to achieve maximum performance.
3. To gain familiarity with a diverse range of machine learning models and algorithms, and apply those techniques in both research and industry contexts.

LEARNING OUTCOMES & GENERIC SKILLS						
No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand foundational concepts of machine learning approaches.	C1, C2, P1	1, 3 7, EP1, EP2	5	1, 3	T
CO2	Apply linear regression, logistic regression and regularization to any machine learning problem.	C2, C3, A1			2	F, T
CO3	Apply ML algorithms to a real-world problem, optimize the ML models for enhancing model performances.	C1-C6, A2, P3 - P5			6	MT, Pr, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand foundational concepts of machine learning approaches.	H											
CO2	Apply linear regression, logistic regression and regularization to any machine learning problem.	M											
CO3	Apply ML algorithms to a real-world problem, optimize the ML models for enhancing model performances.				H								

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Understand the breadth and depth of different machine learning models through which developing an appreciation for the things that are involved in this study.
CO2-PO2	High	Explore the branches of learning algorithms
CO3-PO4	High	Design and solve unique engineering problems by enhancing the learning parameters to achieve maximum performance and better understanding of the subject.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	

Continuous Assessment Mid-Term Exam Final Examination	2 1 3
Total	132

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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 Lec 11 Lec 12	Supervised Learning Unsupervised Learning	Class Test-2
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 Networks	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Support Vector Machine Genetic Algorithm	
9	Lec 25 Lec 26 Lec 27	Reinforcement Learning	
10	Lec 28 Lec 29 Lec 30	Ensemble Learning	
11	Lec 31 Lec 32 Lec 33	Hidden Markov Model	
12	Lec 34 Lec 35 Lec 36	Maximum Likelihood Estimates	Class Test-3
13	Lec 37 Lec 38 Lec 39	Parameter Estimation	
14	Lec 40 Lec 41 Lec 42	Computational Learning Theory	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
	Test 1-3	20%	CO1	C1, C2
			CO2	C2,C3

Continuous Assessment (40%)	Class Participation	5%	-	A2
	Mid term	10%	CO3	C4-C6, P6
	Attendance	5%	-	-
Final Exam		60%	CO1, CO3	C1- C6
			CO4	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Pattern Recognition and Machine Learning - Christopher M. Bishop; Springer
2. Machine Learning - Tom Mitchell, McGraw Hill (International Edition)
3. Introduction to Machine Learning, Second Edition - Ethem Alpaydin (2^{nd} Edition)
4. Pattern Recognition –Sergios Theodoridis and Konstantinos Koutroumbas; Elsevier Inc.
5. Machine Learning: An Algorithmic Perspective - Stephen Marsland

REFERENCE SITE

CSE-442: Machine Learning Sessional

COURSE INFORMATION

Course Code Course Title	: CSE 442 : Machine Learning Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Machine Learning Sessional course is structured to orient different algorithm of machine learning practically to best suit the current need. This course will help understand the iterative aspect of machine learning as models are exposed to new data, they are able to independently adapt. Models learn from previous computations to produce reliable, repeatable decisions and results and helps in implementing 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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.	C2-C6, P1, P6	1, 2, 6, 3, 7,	1, 2, 4, 3	6	T, Q

CO2	Evaluate the strengths and weaknesses of many popular machine learning approaches.	C3, C6, A4, A5, P6			8	ASG, T
CO3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.	C2 – C6 P1, A1, A2			2	R, Q, Pr
CO4	Design and implement various machine learning algorithms in a range of real-world applications.	P3, A4, C3, C4, C6			5	T, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Supervised Learning: Regression, Model Selection and Generalization, Dimensions of a supervised learning algorithm; **Bayesian Decision:** Association Rules, Discriminant Functions; **Clustering:** k-means cluster, Hierarchical cluster, Expectation-Maximization Algorithm, Supervised Learning after Clustering; **Decision Tree:** Classification tress, Regression trees, Pruning, Multivariate trees; **Hidden Markov Model:** Basic problems of HMM, Evaluation problem, Model Selection in HMM, Find State Sequence; **Kernel Machines**: SVM, Victorian Kernels, Multiple Kernel Learning, One-Class Kernel Machine, Kernel Dimensionality Reduction; **Design and Analysis of ML Experiment:** Randomization, Interval Estimation, McNemer's Test, K-Fold Cross-Validated Paired t Test, Binomial Test, Approximate Normal Test.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Able to develop a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.		H										
CO2	Able to evaluate the strengths and weaknesses of many popular machine learning approaches.					H							
CO3	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.				M								
CO4	Able to design and implement various machine learning algorithms in a range of real-world applications.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	Able to understand the complexity in analysis of data. Model selection, challenges and fundamental issues of machine learning.
CO2-POe	High	Able to identify the appropriate modern tools or learning algorithms and evaluate their strengths and weaknesses.
CO3-POd	Medium	Able to appreciate the mathematical relationships and in depth investigation and experimentation of the paradigms of supervised and unsupervised learning.
CO4-POc	High	Able to implement Machine Learning algorithms and develop unique solutions to engineering problems from real-world.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Mid-Term Exam Final Examination	 2 - 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab -1, 2	**Supervised Learning:** Regression, Model Selection and Generalization, Dimensions of a supervised learning algorithm;	3.00 in alternate week
3	Lab -3, 4	**Bayesian Decision:** Association Rules, Discriminant Functions;	
5	Lab -5, 6	**Clustering:** k-means cluster, Hierarchical cluster, Expectation-Maximization Algorithm, Supervised Learning after Clustering;	
7	Lab -7, 8	**Decision Tree:** Classification tress, Regression trees, Pruning, Multivariate trees;	
9	Lab -9, 10	**Hidden Markov Model:** Basic problems of HMM, Evaluation problem, Model Selection in HMM, Find State Sequence;	
11	Lab -11, 12	**Kernel Machines**: SVM, Victorian Kernels, Multiple Kernel Learning, One-Class Kernel Machine, Kernel Dimensionality Reduction;	
13	Lab -13, 14	**Design and Analysis of ML Experiment:** Randomization, Interval Estimation, McNemer's Test, K-Fold Cross-Validated Paired t Test, Binomial Test, Approximate Normal Test.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	20%	CO1	C2, P6
			CO2	C3, A5
	Mid Term	10%		
	Attendance	5%	CO3	C4, A2, A1
	Class Performance	5%	CO2	C6, A4, P3

Final Exam (Online Test + Quiz)	40%	CO1, CO3	C2-C6, P1
		CO4	P3, A4
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Pattern Recognition and Machine Learning - Christopher M. Bishop; Springer
2. Machine Learning - Tom Mitchell, McGraw Hill
3. Introduction to Machine Learning, Second Edition - Ethem Alpaydin
4. Pattern Recognition –Sergios Theodoridis and Konstantinos Koutroumbas; Elsevier Inc.
5. Machine Learning: An Algorithmic Perspective - Stephen Marsland

REFERENCE SITE

CSE-443: Pattern Recognition

COURSE INFORMATION

Course Code	: CSE-443	Lecture Contact Hours	: 3.00
Course Title	: Pattern Recognition	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 and 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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify areas where pattern recognition techniques can offer a solution	C1-C3	1, 7	1,3	3	T, F
CO2	Analyze the strength and limitations of some techniques used in pattern recognition for classification, regression and density estimation problems.	C4			1, 3	MT
CO3	Solve problems in regression and classification.	P3			6	F
CO4	Develop communication skill by presenting topics on pattern recognition	A2			5	Q, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify areas where pattern recognition techniques can offer a solution.	H											
CO2	Analyze the strength and limitations of some techniques used in pattern recognition for classification, regression and density estimation problems.		H										
CO3	Solve problems in regression and classification.			H									
CO4	Develop communication skill by presenting topics on pattern recognition										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – POa	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of pattern recognition algorithms
CO2 – POb	High	Able to understand and analyse of pattern recognition algorithms
CO3 – POc	High	Able to implement of pattern recognition algorithms
CO4 --POj	Low	Able to develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Pattern Recognition Importance of Pattern Recognition, Statistical 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 Surface	
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.)	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Dynamic Programming Methods (Contd.) Dynamic Programming Methods (Contd.) Correlation Methods	
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	Class Test 3
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.)	
14	Lec 40 Lec 41 Lec 42	Support Vector Machine Support Vector Machine (Contd.) Support Vector Machine (Contd.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1, C2
			CO 2	C3, C4
	Class Participation	5%	CO 4	A2

	Mid term	10%	CO 3	C4
	Attendance	5%		
Final Exam		60%	CO 1	C1, C2, C3
			CO 2	C4
			CO3	P3
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)

REFERENCE SITE

CSE-444: Pattern Recognition Sessional

COURSE INFORMATION

Course Code Course Title	: CSE 444 : Pattern Recognition sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative Week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand pattern recognition problems and select suitable techniques that can offer a solution	C2, A2		1, 2	5	T, Q

CO3	Implement solution to problems in classification and regression through group project work	C3,A5			6	ASG, Q
CO4	Develop oral and written communication skills to deliver solution on pattern recognition problems	P3,A4			2	R,Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand pattern recognition problems and select suitable techniques that can offer a solution				H								
CO2	Implement solution to problems in classification and regression through group project work									H			
CO3	Develop oral and written communication skills to deliver solution on pattern recognition problems										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – POd	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of pattern recognition algorithms and selecting appropriate solution.
CO2 – Poi	High	Able to analyse and implement solution of pattern recognition tasks.
CO3- POj	High	Able to develop communication skills through writing reports and presenting them.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	21
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab 1,2	Introduction to MATLAB, Python Script, Project Idea Distribution, Project Idea Distribution	3.00 hrs in every alternate week
3	Lab 3,4	Project Proposal Presentation, Bayes Classifier, Home Assignment	
5	Lab 5,6	K-Nearest Neighbour Classification, Home Assignment, Linear Classifiers, Home Assignment	
7	Lab 7, 8	Perceptron Algorithm, Home Assignment, Lab Test 1	
9	Lab 9,10	Clustering Algorithms, Home Assignment, Project Update, Project Update	
11	Lab 11,12	Support Vector Machine, Neural Network, Decision Tree	
13	Lab 13,14	Quis, Viva, Project Final Submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	30%	CO 1	C2, A2
			CO 2	C3, A5
	Class Participation	20%	CO 3	P3, A4
	Presentation	10%	CO 3	P3,A4
Final Exam(Quiz+Viva+Online Test)		40%	CO1, CO2	C2, C3,C4,A2,A5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)

REFERENCE SITE

CSE-445: Digital Signal Processing

COURSE INFORMATION

Course Code Course Title	: CSE-445 : Digital Signal Processing	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Digital Signal Processing course is designed to introduce the fundamental concepts of discrete signal processing and their applications in communications, control and instrumentation.

OBJECTIVE

1. To describe the key theoretical principles underpinning DSP in a design procedure through design examples and case studies.
2. To explain how to use a powerful general-purpose mathematical package such as MATLAB to design and simulate Digital Signal Processing systems.
3. To select and analyze the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
4. To perform real-time signal processing algorithms using the latest fixed-point processor.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the key theoretical principles underpinning DSP in a design procedure through this design examples and case study	C2	1, 2	-	3	T, F
CO2	Evaluate the basic architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.	C5			5	T, M, F
CO3	Analyze and implement signal processing algorithms	C4			3	T, F, PR
CO4	Able to develop the communication skill by presenting topics on operating systems	A2			5	Q, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the key theoretical principles underpinning DSP in a design procedure through this design examples and case study	H											
CO2	Evaluate the basic architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.		H										
CO3	Analyze and implement signal processing algorithms			H									

CO4	Able to develop the communication skill by presenting topics on operating systems										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Amplify depth of knowledge through understanding the key theoretical principles underpinning DSP in a design procedure through this design examples and case study is very important.
CO2-POb	High	Understand and solve various complex problems by analysing the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.
CO3-POc	High	Understand and implement the design issues required to develop and analyse design signal processing algorithms.
CO4-POd	High	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Mid Term Exam	1
Final Examination	3
Total	132

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	Class Test 2
5	Lec 13 Lec 14 Lec 15	Two dimensional sequences and systems	
6	Lec 16 Lec 17 Lec 18	Z-transform Inverse Z-transform H-transform	
7	Lec 19	Frequency domain representation	

	Lec 20 Lec 21	Discrete time systems and signals	
8	Lec 22 Lec 23 Lec 24	Fourier series and Fourier Transform	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Parseval's Theorem	
10	Lec 28 Lec 29 Lec 30	Equivalent Bandwidth Noise Convolution	
11	Lec 31 Lec 32 Lec 33	Correlation Numerical integration	Class Test 3
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.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C5
			CO3	C4
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C5
	Attendance	5%	-	-
Final Exam		60%	CO1	C2
			CO2	C5
			CO3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

CSE-446: Digital Signal Processing Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE-446 : Digital Signal Processing Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE
Course Code: Nil Course Title: Nil
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
The Digital Signal Processing Sessional course is designed to assist 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 use practical knowledge to design and implement a real-time signal processing algorithms using the latest fixed-point processor.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop a good understanding of the fundamental issues and challenges of DSP: data, model selection, model complexity, etc.	C2-C6, P1,P6		1, 2, 3, 4	1,6	T, Q
CO2	Evaluate the strengths and weaknesses of many popular DSP approaches.	C3,C6,A4,A5,P6			8	T, ASG
CO3	Appreciate the underlying mathematical relationships within and across DSP algorithms.	C2-C6,P1,A1-A2			2	R, Q, Pr
CO4	Design and implement various DSP algorithms in a range of real-world applications.	P3,A4,C3-C4.C6			5	T, Q, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop a good understanding of the fundamental issues and challenges of DSP: data, model selection, model complexity, etc.		H										
CO2	Evaluate the strengths and weaknesses of many popular DSP approaches.					H							

CO3	Appreciate the underlying mathematical relationships within and across DSP algorithms.				M								
CO4	Design and implement various DSP algorithms in a range of real-world applications.			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POb	High	Able to understand the complexity in analysis of data. Model selection, challenges and fundamental issues of DSP.
CO2-POe	High	Able to identify the appropriate modern tools or learning algorithms and evaluate their strengths and weaknesses.
CO3-POd	High	Able to appreciate the mathematical relationships and in depth investigation and experimentation of the paradigms of DSP.
CO4-POc	High	Able to implement DSP algorithms and develop unique solutions to engineering problems from real-world.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	21
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	-
Mid Term Exam	2
Final Examination	3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab -1, 2	Discrete time signals Sequences	3.00 in alternate week
3	Lab -3, 4	Linear Constant Coefficient difference equation, Sampling continuous time signals	
5	Lab -5, 6	Two dimensional sequences and systems, Z-transform, Inverse Z-transform, H-transform	
7	Lab -7, 8	Frequency domain representation, Discrete time systems and signals, Fourier series and Fourier Transform	
9	Lab -9, 10	Parseval's Theorem, Equivalent Bandwidth, Noise Convolution	
11	Lab -11, 12	Correlation, Numerical integration, Computation of the DFT	
13	Lab -13, 14	Goertzel FFT, Chirp Z-transform algorithms. Two-dimensional filter design, Quantization effects in digital filters.	

ASSESSMENT STRATEGY				
Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C1, C2
	Class Participation	5%	CO1	C4, C5
			CO3	C4
	Mid term	15%	CO2	C4
Final Exam		60%	CO3	C4, C5
			CO4	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

CSE-449: Mobile and Ubiquitous Computing

COURSE INFORMATION

Course Code	: CSE-449	Lecture Contact Hours	: 3.00
Course Title	: Mobile and Ubiquitous Computing	Credit Hours	: 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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.

<table>
<tr><th colspan="7">LEARNING OUTCOMES & GENERIC SKILLS</th></tr>
<tr><th>No.</th><th>Course Learning Outcome
(Upon completion of the course, the students will be able to)</th><th>Bloom’s Taxonomy</th><th>CP</th><th>CA</th><th>KP</th><th>Assessment Methods</th></tr>
<tr><td>CO1</td><td>Illustrate mobile wireless communication technologies and explain their functioning.</td><td>C1-C2</td><td rowspan="4">1</td><td rowspan="4">1</td><td>1, 3</td><td>T, F</td></tr>
<tr><td>CO2</td><td>Explain the fundamental trade-offs related to resource limitations and communication needs in mobile communication and sensing systems.</td><td>C1-C2</td><td>3</td><td>T, Mid Term Exam, F</td></tr>
<tr><td>CO3</td><td>Discover and compare the range of novel applications based upon mobile systems as well as their particular requirements.</td><td>C3-C4, A2</td><td>2, 3</td><td>Mid Term Exam, F, ASG</td></tr>
<tr><td>CO4</td><td>Develop the communication skill by presenting topics on mobile and ubiquitous computing.</td><td>A2</td><td>5</td><td>PR</td></tr>
</table>

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

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:** 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, SMSMMS, Personal Area Networks (802.11, Bluetooth, IRFIDs), Micro-Electro- Mechanical (MEMES), Recommender systems (Collaborative Filtering, Intelligent Agents). Android Framework, and Application structure.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Illustrate mobile wireless communication technologies and explain their functioning.	H											
CO2	Explain the fundamental trade-offs related to resource limitations and communication needs in mobile communication and sensing systems.		H										
CO3	Discover and compare the range of novel applications based upon mobile systems as well as their particular requirements.				M								

(H–High, M–Medium, L–Low)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	Context Acquisition, Proximity Based Networking Proximity Based Networking (Contd.)	
8	Lec 22 Lec 23 Lec 24	Proximity Based Networking (Contd.), Communication Protocol for Wireless Sensor Network, Human Interaction in Ubiquitous Computing Environment	Mid Term Exam
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 3
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	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1, CO 2	C1, C2
			CO 3	C3, C4
	Class Participation	5%	CO 4	A2
	Mid term	10%	CO2, CO 3	C1, C2, C3, C4, A2
	Attendance	5%		
Final Exam		60%	CO 1	C1, C2
			CO 2	C1, C2
			CO 3	C3, C4, A2
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)

REFERENCE SITE

CSE-450: Mobile and Ubiquitous Computing Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-450 : Mobile and Ubiquitous Computing Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 related to ubiquitous communications and the basics of wireless communications.
2. To develop simple wireless web applications.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate practical skills in developing mobile sensing applications.	C4			4	PR, Q
CO2	Design and create mobile application in team base with presentation.	C6, P3	1	-	5	ASG, PR
CO3	Explain the range of novel applications based upon mobile systems as well as their particular requirements.	C4, A2			6	ASG, Pr, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate practical skills in developing mobile sensing applications.	H											
CO2	Design and create mobile application in team base with presentation.									H			
CO3	Explain the range of novel applications based upon mobile systems as well as their particular requirements.							H					

(H–High, M–Medium, L–Low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-POa	High	Apply knowledge of mobile applications to develop practical skills.
CO2-POb	High	Analyze each problem and propose an appropriate design.
CO2-POi	High	Practice to work in teams as well as individual to design a mobile application.
CO3-POd	Medium	Interpret data to discover the applications of mobile systems.
CO3-POg	High	Discover the applications using mobile technologies and propose different solutions.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-

Practical / Tutorial / Studio Student-Centred Learning	21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lectures	Topics	Remarks
1	Lab-1,2	Introduction to Mobile and Ubiquitous Computing, Affordances of Mobile Systems, Constraints of Mobile Platform, Wireless Fundamentals,	3:00 hrs in alternate week
3	Lab-3,4	Discussion of Project Proposal, Android Programming - Android Framework, Android Application Structure	
5	Lab-5,6	UI components and Layouts, Notification Manager and Listeners, Presentation on the project proposal with report	
7	Lab-7,8	Local- Area Wireless Interfaces on Smartphones	
9	Lab-9,10	Mobile Sensing Strategies, Sensor Sampling	
11	Lab-11,12	Communication Management in Android Java Sockets, Data transfer with Android , Project Update	
13	Lab- 13,14	Submission of Final Project with presentation	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Class Assessment	10%	CO 1	C4
Report	10%	CO1, CO2	C4, C6, P3
Viva/ presentation	10%	CO3	C4, A2
Class Participation	10%	CO3	C4, A2
Project	40%	CO2	C6, P3
Final Quiz	20%	CO1	C4
		CO3	C4, A2
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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; Create Space Independent Publishing Platform (2017)

REFERENCE SITE

CSE-451: Simulation and Modeling

COURSE INFORMATION			
Course Code Course Title	: CSE-451 : Simulation and Modeling	Lecture Contact Hours Credit Hours	 : 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 analyse a system's behaviour for real life problems.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Define basic concepts in modeling and simulation (M&S)	C1, C2	1, 4, 3,	1, 3, 5	1,3	T
CO2	Classify various simulation models and give practical examples for each category	C2, C3			2,5	MT, F
CO3	Construct a model for a given set of data and motivate its validity	C4-C6			2	F
CO4	Develop the communication skill by presenting topics on simulation and modeling	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Simulation modelling 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 for comparing real-world observations and simulated 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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Define basic concepts in modeling and simulation (M&S)	H											

CO2	Classify various simulation models and give practical examples for each category				H								
CO3	Construct a model for a given set of data and motivate its validity			H									
CO4	Develop the communication skill by presenting topics on simulation and modeling										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	For defining the basic concepts depth of knowledge will be necessary
CO2-POd	High	Investigation and experimentation are required in order to classify different methods and to give proper example
CO3-POc	High	Designing and development of a simulation model according to dataset
CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	Mid Term Exam
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 2
9	Lec 25 Lec 26 Lec 27	Monte Carlo Simulation (Contd.) Generating Random Variables Random Variable Method: Inverse Transform	
10	Lec 28 Lec 29 Lec 30	Random Variable Method: Composition Random Variable Method: Convolution Random Variable Method: Acceptance -Rejection	
11	Lec 31 Lec 32 Lec 33	Random Variable Method: Acceptance -Rejection (Contd.), Mathematical Problems for Inverse Method Generating Random Variates	Class Test 3
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 Mode	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C2
	Presentation	5%	CO4	A2
	Mid term	10%	CO2	C2-C3
	Attendance	5%	-	-
Final Exam		60%	CO2, CO3	C2-C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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

REFERENCE SITE

CSE-452: Simulation and Modeling Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE-452 : Simulation and Modelling Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 characteristics of the simulation result basing on different sets of data and test its validity.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Generate and test random number variants and apply them to develop simulation models	C3, C5, P7		3, 5	2	V, R
CO2	Select and analyze output data produced by a model and test the validity of the model	C2, C4, C5			3	ASG,T,Q
CO3	Construct a model for a given set of data and motivate its validity	C6			5,6	ASG,T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; V-Viva; F – Final Exam, MT- Mid Term Exam)

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Generate and test random number variants and apply them to develop simulation models												H
CO2	Select and analyze output data produced by a model and test the validity of the model		H										
CO3	Construct a model for a given set of data and motivate its validity			H									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-POl	High	By learning to produce random variables and applying them will continue life-long preparation for various fields
CO2-POb	High	Complex analysis is necessary to evaluate outcome of the model
CO3-POc	High	Developing an appropriate and valid model in terms of given data

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lec 1, 2	Single Server Queuing System	3:00 hrs in alternate week
3	Lec 3, 4	Inventory Management System	
5	Lec 5, 6	Monte Carlo Method	
7	Lec 7, 8	Pure Pursuit Problem	
9	Lec 9, 10	Probability Distribution Fitting	
11	Lec 11, 12	Random Number Generation Hypothesis Testing	
13	Lec 13, 14	Quiz + Viva	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Quiz	20%	CO2	C2, C4, C5
	Report	10%	CO1	C3, C5, P5
	Class Assessment	20%	CO2, CO3	C2, C4-C6
	Viva	10%	CO1	C3, C5, P5
Assignment		40%	CO2, CO3	C2, C4-C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

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

REFERENCE SITE

CSE-455: Natural Language Processing

COURSE INFORMATION			
Course Code Course Title	: CSE 455 : Natural Language Processing	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE
Course Code: Nil Course Title: Nil

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop the knowledge on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.	C3, C6, P1	1,3	1	1	T, F
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.	C2-C4, P4			1, 3	MT, F
CO3	Enable to implement the NLP technique in different application	C3, C5, C6			5,6	T, F
CO4	Develop the communication skill by presenting topics on Natural Language Processing	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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**: - RNN used for language modelling 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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop the knowledge on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.	H											
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.		H										
CO3	Enable to implement the NLP technique in different application					H							
CO4	Develop the communication skill by presenting topics on Natural Language Processing										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justification
CO1-POa	High	Able to understand the basic concept and application of text based natural language processing
CO2-POb	High	Apply and examine the different machine learning technique used in NLP.
CO3-Poe	High	Construct different real time application using different NLP techniques and evaluate to maximize the better performance.
CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method, Co-operative and Collaborative Method.

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Intro to NLP and Deep Learning; Simple Word Vector representations: word2vec, GloVe;	Class Test 1
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	
4	Lec 10 Lec 11 Lec 12	Neural Networks and Back-Prop, gradient checks, overfitting, regularization, activation functions	Class Test 2
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	
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)	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Convolutional neural networks -- for sentence classification	
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;	Class Test 3
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.	
14	Lec 40 Lec 41 Lec 42	Deep Learning for NLP: Dynamic Memory Networks	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C3, C6, P1
			CO 2	C2-C4, P4
			CO 3	C3, C5, C6
	Class Participation	5%	CO4	A2
	Mid term	10%	CO 2	C2-C4, P4
	Attendance	5%		

Final Exam	60%	CO 1	C3, C6, P1
		CO 2	C2-C4, P4
		CO 3	C3, C5, C6
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. A Primer on Neural Network Models for Natural Language Processing - Yoav Goldberg; Morgan & Claypool Publishers (2017)

REFERENCE SITE

CSE-456: Natural Language Processing Sessional

COURSE INFORMATION

Course Code Course Title	: CSE 456 : Natural Language Processing Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative weeks : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 dayto-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.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop the skill on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.	C3, C6, P1	1,3	1	1	T, F
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.	C2-C4, P4			1, 3	MT, F
CO3	Enable to implement the NLP technique in different application	C3, C5, C6			5,6	T, F

CO4	Develop the communication skill by presenting topics on Natural Language Processing.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop the skill on natural language processing and to learn how to apply basic techniques for text-based processing of natural language.									H			
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.							H					
CO3	Enable to implement the NLP technique in different application						H						
CO4	Develop the communication skill by presenting topics on Natural Language Processing										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justification
CO1-POi	High	Able to understand the basic concept and application of text based natural language processing
CO2-POg	High	Apply and examine the different machine learning technique used in NLP.
CO3-POf	High	Construct different real time application using different NLP techniques and evaluate to maximize the better performance.
CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture	21
Self-Directed Learning Assessment Preparations	10.5
Formal Assessment Continuous Assessment Final Examination	3 1.5
Total	36

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method, Co-operative and Collaborative Method.

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab-1,2	Practical session on language models and softmax, single layer networks;	3:00 hrs in alternate week
3	Lab-3,4	Practical session on Neural Networks and backpropagation for named entity recognition;	
5	Lab-5,6	Understanding workflow of Tensorflow Practical session on Recurrent neural networks for language modeling and other tasks;	
7	Lab-7,8	Practical session on GRUs and LSTMs for machine translation	
9	Lab-9,10	Practical session on Recursive neural networks for parsing	
11	Lab-11,12	Practical session on Convolutional neural networks for sentence classification	
13	Lab-13,14	Practical session on Convolutional neural networks for Speech recognition	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Online	20%	CO2	C2-C4, P4
	Quiz	20%	CO2	C2-C4, P4
			CO3	C3, C5, C6
	Class Participation	10%	CO4	A2
	Assignment	30%	CO1	C3, C6, P1
			CO3	C3, C5, C6
	Class Evaluation	20%	CO1	C3, C6, P1
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. A Primer on Neural Network Models for Natural Language Processing - Yoav Goldberg; Morgan & Claypool Publishers (2017)

REFERENCE SITE

CSE-457: Advanced Database Management Systems

COURSE INFORMATION

Course Code Course Title	: CSE 457 : Advance Database Management Systems	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 analyse and evaluate different models and methods of database systems for certain context using complex data and functions.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Explain and evaluate the fundamental theories and requirements that influence the design of modern database systems	C2-C4, P2	1,3		1	T, F
CO2	Assess and apply database functions and packages suitable for enterprise database development and database management.	C3-C4			1, 3	MT, F
CO3	Critically evaluate alternative designs and architectures for databases and data warehouses.	C4, C5			5,6	T, F
CO4	Discuss and evaluate methods of storing, managing and interrogating complex data.	C1-C4, A5			1-3	T, F
CO5	Develop the communication skill by presenting topics on database management system.	A2		1		Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Explain and evaluate the fundamental theories and requirements that influence the design of modern database systems		H										
CO2	Assess and apply database functions and packages suitable for enterprise database development and database management.			H									

CO3	Critically evaluate alternative designs and architectures for databases and data warehouses.		H										
CO4	Discuss and evaluate methods of storing, managing and interrogating complex data.		H										
CO5	Develop the communication skill by presenting topics on database management system										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justification
CO1-POb	High	Explain and evaluate the fundamental concept and application of database systems.
CO2-POc	High	Apply the SQL concept to solve complex queries using database project.
CO3-POb	High	Design and evaluate the basic concept of commercial project with the help of SQL queries and comparison technique to evaluate the working performance.
CO4-POb	High	Able to store, manage and interrogating the complex data
CO4-POj	Low	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method, Co-operative and Collaborative Method.

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
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	Distributed Database	

	Lec 14 Lec 15	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.)	Mid Term Exam
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 3
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.)	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C2-C4, P2
			CO 3	C4, C5
			CO 4	C1-C4, A5
	Class Participation	5%	CO 5	A2
	Mid term	10%	CO 2	C3-C4
	Attendance	5%		
Final Exam		60%	CO 1	C2-C4, P2
			CO 2	C3-C4
			CO 3	C4, C5
			CO 4	C1-C4, A5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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, AddisonWesley
3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, Third edition

REFERENCE SITE

CSE-458: Advanced Database Management Systems Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE 458 : Advance Database Management Systems Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative weeks : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

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 analyse different security aspects of complex data transactions using different database techniques.

LEARNING OUTCOMES& GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Solve and apply the advanced knowledge in different projects with a commercial relational database system (Oracle)	C3, C4, P1	1,3	1	1	T, F
CO2	Embed security aspects in the developed systems aspects of data transaction.	C4, C5			1, 3	MT, F
CO3	Explain the methods of storing, managing and interrogating complex data.	C2-C4			5,6	T, F
CO4	Develop the communication skill by presenting topics on database management system.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Solve and apply the advanced knowledge in different projects with a commercial relational database system (Oracle)											H	
CO2	Embed security aspects in the developed systems aspects of data transaction.						H						

CO3	Explain the methods of storing, managing and interrogating complex data.							H					
CO4	Develop the communication skill by presenting topics on database management system										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justification
CO1-POk	High	Able to understand the advance knowledge of database in commercial project.
CO2-POf	High	Combine security aspect with better performance in data transaction.
CO3-POg	High	Able to store, manage and interrogate complex data in commercial project.
CO4-POj	High	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture	21
Self-Directed Learning Assessment Preparations	10.5
Formal Assessment Continuous Assessment Final Examination	3 1.5
Total	36

TEACHING METHODOLOGY

Lecture and Discussion, Problem Based Method, Co-operative and Collaborative Method.

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab 1	Introduction to Oracle Installation, Introduction to Oracle Installation (Contd.), Lab Assignment	
2	Lab 2	Basic SQL Query: Data Expressions, Lab Assignment Home Assignment	
3	Lab 3	Advanced SQL Query and Sub-Query, Lab Assignment Home Assignment	
4	Lab 4	Advanced SQL Query and Sub-query (Contd.), Lab Assignment, Home Assignment	
5	Lab 5	Constraints, Lab Assignment, Home Assignment	
6	Lab 6	Presentation on the project proposal, Submission of a report	
7	Lab 7	Authentication and Security, Lab Assignment, Home Assignment	
8	Lab 8	Submission of the E- R diagram, Submission of Schema diagram, Show Project Update	
9	Lab 9	Introduction to PL Packages, Introduction to PL Packages (Contd.), Lab Assignment	
10	Lab 10	Indexing, Hashing, Lab Assignment	
11	Lab 11	Presentation of Back End (SQL), Report Submission	
12	Lab 12	Show Project Update	
13	Lab 13	Introduction to Database Trigger/Procedure, Lab Assignment, Home Assignment	
14	Lab 14	Viva, Submission of Final Project, Project Presentation	

ASSESSM1ENT STRATEGY				
Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Online	20%	CO2	C4, C5
	Quiz	20%	CO2	C4, C5
			CO3	C2-C4
	Class Participation	10%	CO4	A2
	Assignment	30%	CO1	C3, C4, P1
			CO3	C2-C4
	Class Evaluation	20%	CO1	C3, C4, P1
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE 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)

REFERENCE SITE

CSE-459: Internet of Things (IoT)

COURSE INFORMATION

Course Code Course Title	: CSE 459 : Internet of Things (IoT)	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Internet of Things (IoT) course introduces the emergence of IoT and its contribution in providing effective solution for an industrial environment. The course provides a comprehensive discussion on the fundamentals of the technology, architecture, challenges and issues (security, safety) of an overall IoT system.

OBJECTIVE

1. To understanding of how IoT systems are developed.
2. To understand how IoT systems contribute in industrial revolution.
3. To understand the challenges and issues (security, safety) of IoT.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand fundamental concepts and the details of architectural framework of IoT.	C1, C2	1, 2, 3	3, 4, 1	3	T, F

CO2	Design the architecture and network models of IoT technology and apply appropriately to different types of industrial context.	C3, C6			5	T, MT
CO3	Analyse the challenges, security and safety issues of an IoT system.	C4			7	F
CO4	Develop the communication skill by presenting topics on information system design and development.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Evolution of IoT: history and emergence of IoT; **Applications of IoT:** case studies on a number of industries - power, water, healthcare, transportation, oil and gas, construction, agriculture, gene sequencers, mining and race cars. **The IoT landscape:** devices, wireless networks, cloud, sensors, architectures; **Introduction to IoT and embedded systems:** introductory concept of IoT and big data, cloud computing and edge computing; **IoT system architectures:** IoT-oriented standards, protocols and databases; **IoT devices:** the IoT device design space and platform design; **Event-driven system:** IoT event analysis; **IoT network model:** single-hub network and multi-hub network; **Industrial IoT:** industrial 4.0, IIoT architecture, applications and basic challenges; **Security and safety:** system security, network security, generic application security, privacy and dependability; **Security testing of IoT systems:** fuzz testing for security – white-box fuzzing, black-box fuzzing, fuzzing industrial control network systems.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand fundamental concepts and the details of architectural framework of IoT.	H											
CO2	Design the architecture and network models of IoT technology and apply appropriately to different types of industrial context.			H									
CO3	Analyse the challenges, security and safety issues of an IoT system.		H					M					
CO4	Develop the communication skill by presenting topics on information system design and development.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POa	High	Understand basic concepts IoT technology and various modules through an in-depth knowledge of architectural framework of IoT.
CO2-POc	High	Understand how to design IoT systems appropriately by applying different types of architecture and network models for different types of industrial context.
CO3-POb	High	Acquire knowledge for analysing the challenges of an IoT system and interpret accordingly.
CO3-POg	Medium	Understand the security and safety issues and its impact on the components of an IoT system.
CO4-POj	Low	Develop communication skills through participating presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-

Student-Centred Learning	-
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	1	Evolution of IoT	Class Test 1
	2	Evolution of IoT (Contd.)	
	3	Evolution of IoT (Contd.)	
2	4	Applications of IoT	
	5	Applications of IoT (Contd.)	
	6	Applications of IoT (Contd.)	
3	7	The IoT landscape	
	8	The IoT landscape: devices	
	9	The IoT landscape: architectures	
4	10	The IoT landscape: cloud	Class Test 2
	11	The IoT landscape: sensors	
	12	The IoT landscape: wireless networks	
5	13	Introduction to IoT and embedded systems	
	14	Introduction to IoT and embedded systems (Contd.)	
	15	Introduction to IoT and embedded systems (Contd.)	
6	16	IoT system architectures	
	17	IoT system architectures: standards	
	18	IoT system architectures: protocols	
7	19	IoT system architectures: protocols	Mid Term Exam
	20	IoT system architectures: databases	
	21	IoT system architectures: databases	
8	22	IoT devices	
	23	IoT devices (Contd.)	
	24	IoT devices (Contd.)	
9	25	Event-driven system	
	26	Event-driven system (Contd.)	
	27	Event-driven system (Contd.)	
10	28	IoT network model	
	29	IoT network model (Contd.)	
	30	IoT network model (Contd.)	
11	31	Industrial IoT	Class Test 3
	32	Industrial IoT (Contd.)	
	33	Industrial IoT (Contd.)	
12	34	Security and safety	
	35	Security and safety: privacy	
	36	Security and safety: dependability	
13	37	Security and safety: system security	
	38	Security and safety: network security	
	39	Security and safety: generic application security	
14	40	Security testing of IoT systems	
	41	Security testing of IoT systems: white-box fuzzing	
	42	Security testing of IoT systems: black-box fuzzing	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C3, C6
	Class Participation	5%	CO4	A2
	Mid term	10%	CO2	C3, C6
	Attendance	5%		
Final Exam		60%	CO1	C1, C2
			CO3	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies (1st Edition) by Dimitrios Serpanos and Marilyn Wolf; Springer
2. The Internet of Things (1st Edition) by Samuel Greengard; The MIT Press Essential Knowledge series
3. Precision: Principles, Practices and Solutions for the Internet of Things (Kindle Edition) by Timothy Chou; eBook
4. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security (1st Edition) by Perry Lea; Packt

REFERENCE SITE

CSE-460: Internet of Things (IoT) Sessional

COURSE INFORMATION

Course Code Course Title	: CSE 460 : Internet of Things (IoT) Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative weeks : 0.75

PRE-REQUISITE

Course Code: CSE 459
Course Title: Internet of Things (IoT)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Internet of Things (IoT) Sessional course provides a practical experience on developing innovative solutions for a variety of industrial context by applying the technology used to design and develop an IoT system. This course further provides hands on experience on different kinds of components that form the architecture of an IoT system, how they communicate, how they store data and the kinds of distributed/embedded system that are required to support the IoT system.

OBJECTIVE

1. To learn how to deploy and program IoT platforms that provide gateways, sensors, data storage/cloud, devices, processing and access control functionality.

2. To get oriented with various open-source tools to design and develop architectural frameworks for an IoT system.
3. To implement a prototype of an IoT system for a real world industrial scenario.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify the components and setup connections among them to design the IoT architecture for an industrial context.	C2, C3, P1	1, 3	3, 1	5	PR, Pr, R, Viva
CO2	Analyse and evaluate appropriate communication protocols for the IoT system.	C4, C5			6	PR, Pr, R, Viva
CO3	Use modern tools to design and develop prototypes for the IoT system.	C3, C6, P4			4	PR, Pr, R, Viva
CO4	Develop the communication skill by presenting topics on software engineering sessional.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Applications of IoT: case studies on a number of industries - power, water, healthcare, transportation, oil and gas, construction, agriculture, gene sequencers, mining and race cars. **The IoT landscape:** devices, wireless networks, cloud, sensors, architectures; **Introduction to IoT and embedded systems:** introductory concept of IoT and big data, cloud computing and edge computing; **IoT system architectures:** IoT-oriented standards, protocols and databases; **IoT devices:** the IoT device design space and platform design; **Event-driven system:** IoT event analysis; **IoT network model:** single-hub network and multi-hub network; **Security and safety:** system security, network security, generic application security, privacy and dependability; **Orientation and usage of modern tools:** programming in C/C++ (for programming the edge device), programming in Python using such frameworks as TensorFlow (for ML-related tasks), containerized apps deployment using Kubernetes, docker, computer networks, Apache Kafka, ElasticSearch, Kibana, Apache Flink, Linux administration and familiarity with Amazon web technologies.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Identify the components and setup connections among them to design the IoT architecture for an industrial context.	H											
CO2	Analyse and evaluate appropriate communication protocols for the IoT system.		H										
CO3	Use modern tools to design and develop prototypes for the IoT system.			H									
CO4	Develop the communication skill by presenting topics on software engineering sessional.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications

CO1-POa	High	Acquire a strong level of knowledge to identify the components and connections for designing an IoT system for an industrial context.
CO2-POb	High	Analyse and interpret different communication protocols to understand which protocols are appropriate for an IoT architecture.
CO3-POc	High	Design and develop prototypes for an IoT system architecture to solve complex industrial problems using modern engineering and IT tools.
CO4-POi	Low	Develop communication skills through participating in presentation.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Final Project Assessment and Viva	3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	1 2 3	Introducing IoT technology, its applications and discussion on possible innovative project ideas	-
2	4 5 6	Identifying components (devices, sensors, data storage/cloud, gateways) and relevant connectivity	Project, Report, Viva/ Presentation
3	7 8 9	Networking, loading and linking communication protocols to design the IoT architectural framework	Project, Report, Viva/ Presentation
4	10 11 12	Functioning system programming and other dependencies for the IoT system	Project, Report, Viva/ Presentation
5	13 14 15	Cloud and IoT integration and processing cloud computing services.	Project, Report, Viva/ Presentation
6	16 17 18	Developing a prototype for the IoT system	Project, Report, Viva/ Presentation
7	19 20 21	Final documentation and project submission	Project, Report, Viva/ Presentation

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Report/Documentation	20%	CO1	C2, C3, P1
			CO2	C4, C5
			CO3	C3, C6, P4
	Class Participation	5%	CO4	A2

	Presentation	15%	CO1	C2, C3, P1
			CO2	C4, C5
			CO3	C3, C6, P4
Final Project Assessment and Viva		60%	CO1	C2, C3, P1
			CO2	C4, C5
			CO3	C3, C6, P4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Internet of Things (A Hands-on-Approach) (1st Edition) by Arshdeep Bagha and Vijay Madisetti; VPT
2. Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (1st Edition) by Cuno Pfister; Maker Media
3. Learning Internet of Things (1st Edition) by Peter Waher.

REFERENCE SITE

CSE-461: Industrial Revolution

COURSE INFORMATION

Course Code Course Title	: CSE-461 : Industrial Revolution	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course introduces the fundamentals of industrial revolution, the design and development principles, trajectory generation, 4^{th} industrial revolution. This course also introduces with the Millennium Development Goal (MDG) and its impact on industries in 21^{st} century. It's a fusion of advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing, and other technologies.

OBJECTIVE

1. To explain the basics of Industrial revolution and its impact on Computer Science.
2. To specify and analyse the trend and technology of modern computer science based industry.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Understand the importance of the concept of industrial revolution and explore the technologies related to it.	C1, C2, P1, A1	1 2, 3, 5,	1 3, 5	1, 2	T
CO2	Solve modern world problems using the basic knowledge of industrial revolution as well as develop ideas to	C4, A2, A4, P5, P6			3, 4	F, T

	approach a solution from different perspective.					
CO3	Imply the ideas of 4IR and use it to develop a the soft and technical skills required to face the upcoming challenges.	C3, C4, C6, P3, P7, A4, A5			5, 6	MT, PR, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction: Brief overview of Industrial Revolution; **History**: 1st, 2nd and 3rd Industrial Revolution; **Major Fields**: Industrial Revolution in the field of AI, genetic engineering, 3D printing, Internet of Things (IoT), Robotics; **4IR:** Study of Workforce Readiness, Soft skills, Technical skills, Entrepreneurship. **Social Effects:** Global and Local aspects of industrialization, social consequences, debates and histography concepts.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Understand the importance of the concept of industrial revolution and explore the technologies related to it.	H											
CO2	Solve modern world problems using the basic knowledge of industrial revolution as well as develop ideas to approach a solution from different perspective.		H										
CO3	Imply the ideas of 4IR and use it to develop a the soft and technical skills required to face the upcoming challenges.												H

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Understand the breadth and depth of concept industrialization.
CO2-PO2	High	Analyse complex modern problems and understand the ways to solve them.
CO3-PO3	High	Learn the ideas of 4IRs to imply throughout life and prepare for the depth of continuous learning process

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assessment Preparations	21
Formal Assessment	
Continuous Assessment	2
Mid-Term Exam	1
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Brief overview of Industrial Revolution	Class Test-1
2	Lec 4 Lec 5 Lec 6	History: 1st Industrial Revolution 2nd Industrial Revolution	
3	Lec 7 Lec 8 Lec 9	History: 3rd Industrial Revolution	
4	Lec 10 Lec 11 Lec 12	Industrial Revolution in the field of Artificial Intelligence.	Class Test-2
5	Lec 13 Lec 14 Lec 15	Industrial Revolution in the field of Internet of Things (IoT).	
6	Lec 16 Lec 17 Lec 18	Industrial Revolution in the field of Computer Technology and Networking.	
7	Lec 19 Lec 20 Lec 21	Industrial Revolution in the field of Microcomputers and Robotics.	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Introduction to 4th Industrial Revolution	
9	Lec 25 Lec 26 Lec 27	4IRs Study of Workforce readiness Soft Skills	
10	Lec 28 Lec 29 Lec 30	Technical Skills	
11	Lec 31 Lec 32 Lec 33	Entrepreneurship	Class Test-3
12	Lec 34 Lec 35 Lec 36	Global Effects of Industrialization Local Effects of Industrialization	
13	Lec 37 Lec 38 Lec 39	MDG and its impact on Industrial Revolution	
14	Lec 40 Lec 41 Lec 42	Debates Histography Impacts of IR in Computer Science	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C3, C4
	Class Participation	5%	CO3	A2
	Mid term	10%	CO2	C4, P6

	Attendance	5%	-	-
Final Exam		60%	CO1, CO3	C1-C4, C6
			CO2	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Rule, John. 1986. The Labouring Class in Early Industrial England, 1750-1850. London and New York: Longman.
2. Wrigley, E. A. 1988. Continuity, Chance and Change: The Character of the Industrial Revolution in England. Cambridge: Cambridge University Press.
3. Aspin, Chris. 1981. The Cotton Industry. Princes Riseborough, Buckinghamshire: Shire Publications.

REFERENCE SITE

CSE-462: Industrial Revolution Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-462 : Industrial Revolution Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative weeks : 0.75

PRE-REQUISITE

Course Code: CSE-461
Course Title: Industrial Revolution

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

The Industrial Revolution Sessional course is structured to orient with different industries.

OBJECTIVE

1. To implement some ideas based on the 4IRs of 4^{th} Industrial Revolution.
2. To use practical knowledge to enhance the learning experience and gather information on the concept of IR.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop a good understanding of the fundamental issues and challenges of Industrial Revolution.	C2-C6, P1, P6	1, 2	1, 2	6	T, Q
CO2	Evaluate the strengths and weaknesses of many industries.	C3, C6, A4, A5, P6			8	ASG, T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Visit to Different Industries and apply the knowledge gained in the Theory Course.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Develop a good understanding of the fundamental issues and challenges of Industrial Revolution.		H										
CO2	Evaluate the strengths and weaknesses of many industries.					H							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO2	High	Able to understand the complexity in analysis of challenges and fundamental issues of Industrial Revolution.
CO2-PO5	High	Able to identify the appropriate modern tools or techniques by visiting different industries.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	21
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	2
Mid-Term Exam	-
Final Examination	3
Total	26

TEACHING METHODOLOGY

Discussion, Co-operative and Collaborative Method

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lab -1, 2	Visit to a 21st century Industry as seen fit by the Authority.	3.00 in alternate week
3	Lab -3, 4	Discussion on the experience gained visiting the industry.	
5	Lab -5, 6	Visit to a 21st century Industry as seen fit by the Authority.	
7	Lab -7, 8	Discussion on the experience gained visiting the industry.	
9	Lab -9, 10	Visit to a 21st century Industry as seen fit by the Authority.	
11	Lab -11, 12	Visit to a 20th century Industry as seen fit by the Authority.	
13	Lab -13, 14	Discussion on the experience gained visiting the industry.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5
	Class Participation	10%	CO3	C4, A2, A1
	Presentation	10%	CO2	C6, A4, P3
Final Exam (Research Paper + Quiz)		40%	CO1, CO3	C2-C6, P1
			CO4	P3, A4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

REFERENCE SITE

CSE-465: Cyber and Physical Security

COURSE INFORMATION

Course Code Course Title	: CSE-465 : Cyber and Physical Security	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: Nil

Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

To teach students the basics of security issues relating to various cyber-physical systems including industrial control systems and those considered critical infrastructure systems.

OBJECTIVE

1. To examine the architecture of a complex system.
2. To identify significant vulnerabilities and threats, and apply appropriate security technologies and methods to ensure the overall security of the system.
3. To study advanced cybersecurity principles and best practices are applied to develop a comprehensive cyber defense program for an enterprise against cyber threats.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Apply cybersecurity principles and methods to defend an information system against cyber threats.	C1-C2	1	1	1,3,6	T, MT, F
CO2	Analyse the requirements of a comprehensive security plan for an organization.	C4			3	T, F, MT

CO3	Design and customize a comprehensive security plan by integrating network defense tools and measures.	C3, C6			1,3,8	F, MT
CO4	Develop communication skill by presenting topics on cyber and physical security.	A2				Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to the course, Introduction to **Cyber-Physical Systems**, Background on Networking, Information Security, and Control Theory, **Industrial Networks,** Industrial Cyber Security History and Threats, Introduction to Industrial Control Systems And Operations, Industrial Network Design and Architecture, Industrial Network Protocols, Example Industrial Control System - Power Delivery System, Hacking Industrial Control Systems, Securing Industrial Control Systems, **Advanced Cyber-Physical Systems** Security Concepts, Privacy in Cyber-Physical Systems, Threats to Cyber-Physical Systems in Other Domains - (e.g., Transportation Systems)

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Apply cybersecurity principles and methods to defend an information system against cyber threats.	H											
CO2	Analyse the requirements of a comprehensive security plan for an organization.	H											
CO3	Design and customize a comprehensive security plan by integrating network defense tools and measures.		M										
CO4	Develop communication skill by presenting topics on cyber and physical security.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1- POa	High	Interpret the principles and methods of cyber security by developing breadth and depth of knowledge and understanding in the respective areas.
CO2–POa	High	Gain depth of knowledge for analysing the principles and methods of cyber security and their execution process.
CO3–POb	Medium	Gain preliminary experience in complex problem analysis by designing a comprehensive security plan.
CO4- POj	Low	Demonstrate communication skills by presenting on topics as cyber and physical security.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-

Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Cyber-Physical Systems	Class Test 1
2	Lec 4 Lec 5 Lec 6	Background on Networking, Information Security, and Control Theory	
3	Lec 7 Lec 8 Lec 9	Industrial Networks and how they operate	
4	Lec 10 Lec 11 Lec 12	Industrial Cyber Security History and Threats	
5	Lec 13 Lec 14 Lec 15	Industrial Control Systems and Operations	Class Test 2
6	Lec 16 Lec 17 Lec 18	Industrial Network Design and Architecture	
7	Lec 19 Lec 20 Lec 21	Industrial Network Protocols	
8	Lec 22 Lec 23 Lec 24	Example Industrial Control System - Power Delivery System	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Hacking Industrial Control Systems	
10	Lec 28 Lec 29 Lec 30	Securing Industrial Control Systems	
11	Lec 31 Lec 32 Lec 33	Advanced Cyber-Physical Systems Security Concepts	
12	Lec 34 Lec 35 Lec 36	Advanced Cyber-Physical Systems Security Concepts continued…	

13	Lec 37 Lec 38 Lec 39	Privacy in Cyber-Physical Systems	Class Test 3
14	Lec 40 Lec 41 Lec 42	Threats to Cyber-Physical Systems in Other Domains	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C4
			CO3	C3, C6
	Class Participation	5%	CO4	A2
	Mid term	10%	CO1	C1, C2
	Attendance	5%		
Final Exam		60%	CO1	C1, C2
			CO2	C4
			CO3	C3,C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Cyber-Physical Security: Protecting Critical Infrastructure at the State and Local Level by Robert M. Clark
2. Cyber Security for Cyber Physical Systems - 1st ed. 2018 by Saqib Ali.
3. Industrial Network Security, Second Edition: Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Control Systems (2nd Edition), by Eric D. Knapp and Joel Thomas Langill

REFERENCE SITE

CSE-466: Cyber and Physical Security Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-466 : Cyber and Physical Security Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative weeks : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

To teach students the practical aspects of security issues relating to various cyber-physical systems including industrial control systems and those considered critical infrastructure systems.
OBJECTIVE
1. To practice examining the architecture of a complex system. 2. To use methods to identify significant vulnerabilities and threats in physical systems. 3. To apply advanced cybersecurity principles to develop a comprehensive cyber defense program.
LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Demonstrate knowledge and understanding of the range of cyber physical and software systems which present potential security hazards	C2, A2		1, 2	8	E, Q
CO2	Understand and recognize instances of the principal attacks on such systems	C3, A5			6	ASG, Q
CO3	Take appropriate measures to protect systems from security breaches	P3, A4			2	R,Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam, E-Evaluation)

COURSE CONTENT

Concepts and **Principles** of Cyber and Physical security; **Security Breaches** and Defenses in CPS; **Types of attack** and attacker, range of systems; **Security of payment gateways:** Card security, EMV payment systems, GSM and SIM cards; Wired and WiFi network security; **Examples of weak cryptosystems:** GSM, WEP; Infrastructure attacks: smart grids; Hardware Trojans and Trustworthy IC design

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		a	b	c	d	e	f	g	h	i	j	k	l
CO1	Demonstrate knowledge and understanding of the range of cyber physical and software systems which present potential security hazards				H								
CO2	Understand and recognize instances of the principal attacks on such systems		H										
CO3	Take appropriate measures to protect systems from security breaches						H						

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-POd	High	Will be able to gain breadth & depth of investigation and experimentation by demonstrating knowledge and understanding of the range of cyber physical and software systems which present potential security hazards.
CO2-POb	High	Will be able to do problem analysis by understanding and recognizing instances of the principal attacks on such systems
CO3-POf	High	Will develop knowledge and responsibility by taking appropriate measures to protect systems from security breaches

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture	- -

Practical / Tutorial / Studio Student-Centred Learning	21 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	26

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab-1,2	Concepts and Principles of Cyber and Physical security	3:00 hrs in alternate week
3	Lab-3,4	Security Breaches and Defenses in CPS	
5	Lab-5,6	Types of attack and attacker, range of systems	
7	Lab-7,8	Card security, EMV payment systems, GSM and SIM cards	
9	Lab-9,10	Wired and WiFi network security; Examples of weak cryptosystems: GSM, WEP	
11	Lab-11,12	Infrastructure attacks: smart grids	
13	Lab- 13,14	Hardware Trojans and Trustworthy IC design	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test	20%	CO1	C2, A2
			CO2	C3, A5
	Class Performnce	5%	CO3	P3, A4
	Mid Term	10%	CO3	P3, A4
	Attendance	5%	-	-
Final Exam (Quiz + Online Test)		40%	CO1, CO2	C2, C3, C4, A2, A5
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Cyber Security for Cyber Physical Systems - 1st ed. 2018 by Saqib Ali.
2. Industrial Network Security, Second Edition: Securing Critical Infrastructure Networks for Smart Grid, SCADA, and Other Industrial Control Systems (2nd Edition), by Eric D. Knapp and Joel Thomas Langill

REFERENCE SITE

APPENDIX A

TYPES OF EXAM AND ASSOCIATED ISSUES

<table>
<tr><th>Ser</th><th>Exam Type</th><th>Term</th><th>No of Theory Courses</th><th>Max Grading</th><th>Assessment Marks</th><th>Exam Schedule</th><th>Courses</th><th>Registration schedule</th></tr>
<tr><td>1</td><td>Regular</td><td>Spring and Fall</td><td rowspan="2">Max 6 Theory Courses</td><td>A+</td><td rowspan="2">Assessment on 100%</td><td rowspan="2">Regular exam</td><td rowspan="2">Regular</td><td rowspan="2">Regular</td></tr>
<tr><td>2</td><td>Retake</td><td>Spring and Fall</td><td>B+</td></tr>
<tr><td>3</td><td>Supplementary-I (Fail/ Improvement)</td><td>Spring</td><td>Max 2 Theory</td><td>B+</td><td>Assessment on 60%</td><td>1st wk of Spring Term/ Fall Term End Break</td><td>Courses of immediate past term included</td><td>5th wk after completion of Fall Term (Previous Yr)</td></tr>
<tr><td>4</td><td>Supplementary – II (Fail/ Improvement)</td><td>Fall</td><td>Max 1 Theory</td><td>B+</td><td>Assessment on 60%</td><td>1st wk of Fall Term/ Spring Term End Break</td><td>Courses of immediate past term not included</td><td>Mid-term break of Spring Term (March)</td></tr>
</table>

Notes:

i. *Max 24 Cr hr in one regular term (excluding supplementary exams)*

ii. *Students may register maximum up-to 07 theory courses in exceptional cases if Dept can accommodate within 24 Cr hr.*

iii. *Student can register maximum 06 theory courses for Improvement Exam in his whole academic period.*

iv. *Supplementary-I exam to be considered as part of previous academic year*

v. *Students appearing in Supplementary-I shall not be incl in current Graduation Ceremony*

APPENDIX B

EQUIVALENCE TABLE

	Old course(2021-2023)			New Course (2022-2024)		
Ser.	**Course code**	**Course Title**	**Cr.**	**Course code**	**Course Title**	**Cr.**
1.	CSE -101	Discrete Mathematics	3	CSE -101	Discrete Mathematics	3
2.	CHEM-101	Fundamentals of Chemistry	3	CHEM-101	Fundamentals of Chemistry	3
3.	CHEM-102	Chemistry Sessional	1.5	CHEM-102	Chemistry Sessional	0.75
4.	EECE-163	Electrical Circuit Analysis	3	EECE-163	Electrical Circuit Analysis	3
5.	EECE-164	Electrical Circuit Analysis Sessional	0.75	EECE-164	Electrical Circuit Analysis Sessional	0.75
6.	GEBS-101	Bangladesh Studies	2	GEBS-101	Bangladesh Studies	2
7.	MATH-101	Differential and Integral Calculus	3	MATH-101	Differential and Integral Calculus	3
8.	PHY-101	Waves and Oscillations, Optics and Modern Physics	3	PHY-101	Waves and Oscillations, Optics and Modern Physics	3
9.	PHY-102	Physics Sessional	1.5	PHY-102	Physics Sessional	1.5
10.	CSE-103	Digital Logic Design	3	CSE-103	Digital Logic Design	3
11.	CSE-104	Digital Logic Design Sessional	1.5	CSE-104	Digital Logic Design Sessional	1.5
12.	CSE-105	Structured Programming Language	3	CSE-105	Structured Programming Language	3
13.	CSE-106	Structured Programming Language Sessional	1.5	CSE-106	Structured Programming Language Sessional	1.5

14.	EECE-169	Electronic Devices and Circuits	3		EECE-169	Electronic Devices and Circuits	3
15.	EECE-170	Electronic Devices and Circuits Sessional	0.75		EECE-170	Electronic Devices and Circuits Sessional	0.75
16.	LANG-102	Communicative English-I	1.5		LANG-102	Communicative English-I	1.5
17.	MATH-105	Vector Analysis, Matrix and Coordinate Geometry	3		MATH-105	Vector Analysis, Matrix and Coordinate Geometry	3
18.	ME-122	Fundamental of Mechanical Engineering Sessional	2		ME-122	Fundamental of Mechanical Engineering Sessional	2
19.	CSE-203	Data Structures and Algorithms-I	3		CSE-203	Data Structures and Algorithms-I	3
20.	CSE-204	Data Structures and Algorithms-I Sessional	1.5		CSE-204	Data Structures and Algorithms-I Sessional	1.5
21.	CSE-205	Object Oriented Programming Language	3		CSE-205	Object Oriented Programming Language	3
22.	CSE-206	Object Oriented Programming Language Sessional-I	1.5		CSE-206	Object Oriented Programming Language Sessional-I	1.5
23.	CSE-217	Theory of Computation	3		CSE-217	Theory of Computation	3
24.	EECE-269	Electrical Drives and Instrumentation	3		EECE-269	Electrical Drives and Instrumentation	3
25.	EECE-270	Electrical Drives and Instrumentation Sessional	0.75		EECE-270	Electrical Drives and Instrumentation Sessional	0.75
26.	LANG-202	Communicative English-II	1.5		LANG-202	Communicative English-II	1.5
27.	MATH-205	Differential Equations, Laplace Transform and Fourier Transform	3		MATH-205	Differential Equations, Laplace Transform and Fourier Transform	3
28.	CE-250	Engineering Drawing and CAD Sessional	1.5		CE-150	Engineering Drawing and CAD Sessional	0.75

29.	CSE-213	Computer Architecture	3	CSE-213	Computer Architecture	3
30.	CSE-215	Data Structures and Algorithms-II	3	CSE-215	Data Structures and Algorithms-II	3
31.	CSE-216	Data Structures and Algorithms-II Sessional	1.5	CSE-216	Data Structures and Algorithms-II Sessional	1.5
32.	CSE-219	Mathematical Analysis for Computer Science	3	CSE-219	Mathematical Analysis for Computer Science	3
33.	CSE-220	Object Oriented Programming Sessional-II	0.75	CSE-220	Object Oriented Programming Sessional-II	2
34.	EECE-279	Digital Electronics and Pulse Technique	3	EECE-279	Digital Electronics and Pulse Technique	3
35.	EECE-280	Digital Electronics and Pulse Technique Sessional	0.75	EECE-280	Digital Electronics and Pulse Technique Sessional	0.75
36.	GELM-275	Leadership and Management	2	GELM-275	Leadership and Management	2
37.	MATH-207	Complex Variable and Statistics	3	MATH-207	Complex Variable and Statistics	3
38.	CSE-301	Database Management Systems	3	CSE-301	Database Management Systems	3
39.	CSE-302	Database Management Systems Sessional	1.5	CSE-302	Database Management Systems Sessional	1.5
40.	CSE-303	Compiler	3	CSE-303	Compiler	3
41.	CSE-304	Compiler Sessional	0.75	CSE-304	Compiler Sessional	0.75
42.	CSE-305	Microprocessors, Micro-controllers and Assembly Language	3	CSE-305	Microprocessors, Micro-controllers and Assembly Language	3
43.	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.5	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.5

44.	CSE-307	Operating System	3		CSE-307	Operating System	3
45.	CSE-308	Operating System Sessional	0.75		CSE-308	Operating System Sessional	0.75
46.	CSE-317	Data Communication	3		CSE-317	Data Communication	3
47.	CSE-318	Data Communication Sessional	0.75		CSE-318	Data Communication Sessional	0.75
48.	CSE-309	Computer Network	3		CSE-309	Computer Network	3
49.	CSE-310	Computer Network Sessional	1.5		CSE-310	Computer Network Sessional	1.5
50.	CSE-315	Digital System Design	2		CSE-315	Digital System Design	2
51.	CSE-316	Digital System Design Sessional	0.75		CSE-316	Digital System Design Sessional	0.75
52.	CSE-319	Software Engineering	3		CSE-319	Software Engineering	3
53.	CSE-320	Software Engineering Sessional	0.75		CSE-320	Software Engineering Sessional	0.75
54.	CSE-364	Software Development Project - I	1.5		CSE-364	Software Development Project	1.5
55.	GERM-352	Fundamentals of Research Methodology	2		GERM-352	Fundamentals of Research Methodology	1.5
56.	GES-301	Fundamentals of Sociology	2		GES-301	Fundamentals of Sociology	2
57.	GESL-303	Environment, Sustainability and Law	2		GESL-303	Environment, Sustainability and Law	2
58.	CSE-350	Industrial Training	1		CSE-350	Industrial Training	1
59.	CSE-400	Final Year Research & Design Project	3		CSE-400	Final Year Research & Design Project	3

60.	CSE-405	Computer Interfacing	3	CSE-405	Computer Interfacing	3
61.	CSE-406	Computer Interfacing Sessional	0.75	CSE-406	Computer Interfacing Sessional	0.75
62.	CSE-415	Human Computer Interaction	3	CSE-415	Human Computer Interaction	3
63.	-	-	-	CSE-416	Human Computer Interaction Sessional	0.75
64.	CSE-403	Artificial Intelligence	3	CSE-403	Artificial Intelligence	3
65.	CSE-404	Artificial Intelligence Sessional	0.75	CSE-404	Artificial Intelligence Sessional	0.75
66.	CSE-464	Software Development Project-II	1.5	-	-	-
67.	GEEM-433	Engineering Ethics and Moral Philosophy	2	GEEM-433	Engineering Ethics and Moral Philosophy	2
68.	CSE-400	Final Year Research & Design Project	3	CSE-400	Final Year Research & Design Project	3
69.	CSE-401	Information System Design and Development	3	CSE-401	Information System Design and Development	3
70.	CSE-429	Computer Security	3	CSE-429	Computer Security	3
71.	-	-	-	CSE-430	Computer Security Sessional	0.75
72.	CSE-413	Computer Graphics	3	CSE-413	Computer Graphics	3
73.	CSE-414	Computer Graphics Sessional	0.75	CSE-414	Computer Graphics Sessional	0.75
74.	GEPM-463	Project Management and Finance	2	GEPM-463	Project Management and Finance	2

75.	CSE-407	Applied Statistics and Queuing Theory	3.00	-	-	-
76.	CSE-419	Advanced Algorithms	3.00	CSE-419	Advanced Algorithms	3.00
77.	-	-	-	CSE-420	Advanced Algorithms Sessional	0.75
78.	CSE-421	Basic Graph Theory	3.00	CSE-421	Basic Graph Theory	3.00
79.	-	-	-	CSE-422	Basic Graph Theory Sessional	0.75
80.	CSE-423	Fault Tolerance System	3.00	CSE-423	Fault Tolerance System	3.00
81.	-	-	-	CSE-424	Fault Tolerance System Sessional	0.75
82.	CSE-425	Basic Multimedia Theory	3.00	CSE-425	Basic Multimedia Theory	3.00
83.	-	-	-	CSE-426	Basic Multimedia Theory Sessional	0.75
84.	CSE-427	Digital Image Processing	3.00	CSE-427	Digital Image Processing	3.00
85.	-	-	-	CSE-428	Digital Image Processing Sessional	0.75
86.	CSE-431	Object Oriented Software Engineering	3.00	CSE-431	Object Oriented Software Engineering	3.00
87.	-	-	-	CSE-431	Object Oriented Software	0.75

						Engineering Sessional	
88.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00		CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00
89.	-	-	-		CSE-434	Artificial Neural Networks and Fuzzy Systems Sessional	0.75
90.	CSE-435	Distributed Algorithms	3.00		CSE-435	Distributed Algorithms	3.00
91.	-	-	-		CSE-436	Distributed Algorithms Sessional	0.75
92.	CSE-437	Bioinformatics	3.00		CSE-437	Bioinformatics	3.00
93.	-	-	-		CSE-438	Bioinformatics Sessional	0.75
94.	CSE-439	Robotics	3.00		CSE-439	Robotics	3.00
95.	-	-	-		CSE-440	Robotics Sessional	0.75
96.	CSE-447	Telecommunication Engineering	3.00		CSE-447	Telecommunication Engineering	3.00
97.	CSE-411	VLSI Design	3.00		CSE-411	VLSI Design	3.00
98.	CSE-412	VLSI Design Sessional	0.75		CSE-412	VLSI Design Sessional	0.75
99.	CSE-441	Machine Learning	3.00		CSE-441	Machine Learning	3.00
100.	CSE-442	Machine Learning Sessional	0.75		CSE-442	Machine Learning Sessional	0.75

101.	CSE-443	Pattern Recognition	3.00		CSE-443	Pattern Recognition	3.00
102.	CSE-444	Pattern Recognition Sessional	0.75		CSE-444	Pattern Recognition Sessional	0.75
103.	CSE-445	Digital Signal Processing	3.00		CSE-445	Digital Signal Processing	3.00
104.	CSE-446	Digital Signal Processing Sessional	0.75		CSE-446	Digital Signal Processing Sessional	0.75
105.	CSE-449	Mobile and Ubiquitous Computing	3.00		CSE-449	Mobile and Ubiquitous Computing	3.00
106.	CSE-450	Mobile and Ubiquitous Computing Sessional	0.75		CSE-450	Mobile and Ubiquitous Computing Sessional	0.75
107.	CSE- 451	Simulation and Modeling	3.00		CSE- 451	Simulation and Modeling	3.00
108.	CSE- 452	Simulation and Modeling Sessional	0.75		CSE- 452	Simulation and Modeling Sessional	0.75
109.	CSE-455	Natural Language Processing	3.00		CSE-455	Natural Language Processing	3.00
110.	CSE-456	Natural Language Processing sessional	0.75		CSE-456	Natural Language Processing sessional	0.75
111.	CSE-457	Advanced Database Systems	3.00		CSE-457	Advanced Database Systems	3.00
112.	CSE-458	Advanced Database Systems Sessional	0.75		CSE-458	Advanced Database Systems Sessional	0.75
113.	CSE-417	Blockchaining and Cryptocurrency Technology	3.00		CSE-417	Blockchaining and Cryptocurrency Technology	3.00

114.	-	-	-		CSE-418	Blockchaining and Cryptocurrency Technology Sessional	0.75
115.	CSE-459	Internet of Things (IoT)	3.00		CSE-459	Internet of Things (IoT)	3.00
116.	CSE-460	Internet of Things (IoT) Sessional	0.75		CSE-460	Internet of Things (IoT) Sessional	0.75
117.	CSE-461	Industrial Revolution	3.00		CSE-461	Industrial Revolution	3.00
118.	CSE-462	Industrial Revolution	0.75		CSE-462	Industrial Revolution	0.75
119.	CSE-465	Cyber & Physical Security	3.00		CSE-465	Cyber & Physical Security	3.00
120.	CSE-466	Cyber & Physical Security Sessional	0.75		CSE-466	Cyber & Physical Security Sessional	0.75