MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

SYLLABUS

BACHELOR OF SCIENCE
IN
COMPUTER SCIENCE AND ENGINEERING (CSE)

APPLICABLE FOR CSE – 21 TO ONWARD BATCHES

REVISED ON DECEMBER 2020

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.

CERTIFICATE

Certified that this syllabus of Bachelor of Science in Computer Science and Engineering (BSc in CSE) of Military Institute of Science and Technology (MIST) is prepared by the committee as under:

Convener:

Col Mohammad Shahjahan Majib, psc
Head
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Members (Internal, Department of CSE):

Brig Gen A K M Nazrul Islam, PhD
Head
Department of Electrical, Electronics and Communication Engineering (EECE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Dr. Md. Mahbubur Rahman
Professor
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Col Siddharth Malik, SM
Senior Instructor
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Lt Col Muhammad Nazrul Islam, PhD, Sigs
Instructor Class-A
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Lt Col Md Fazle Rabbi, psc, EME
Instructor Class-A
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Lt Col Brajalal Sinha, PhD, AEC
Instructor Class-A
Department of Science & Humanities (SH)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Lt Col Tahmina Sultana, PhD, Engrs
Instructor Class-A
Department of Science & Humanities (SH)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Dr. T. M. Shahriar Sazzad
Assistant Professor
Department of Computer Science & Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Maj Md. Manwarul Haq, PhD, AEC
Instructor Class-B
Department of Science & Humanities (SH)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Lt Cdr S M Anisur Rahman, BN
Instructor Class-B
Department of Computer Science and Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Tasmiah Tamzid Anannya
Lecturer
Department of Computer Science & Engineering (CSE)
Military Institute of Science and Technology (MIST)
Mirpur Cantonment, Dhaka-1216

Members (BUP):

Brig Gen Md. Anwar Shafiq, ndc, psc
Inspector of College
Bangladesh University of Professionals (BUP)

Brig Gen Md Zahidur Rahim, ndc, afwc, psc
Dean
Faculty of Science and Technology (FST)
Bangladesh University of Professionals (BUP)

Members (External, Industry):

Dr. M. Sohel Rahman
Professor
Department of Computer Science and Engineering (CSE)
Bangladesh University of Engineering and Technology (BUET)

Engr. Mohammad Enamul Kabir
Director (Training & Development)
Bangladesh Computer Council (BCC)
Agargaon, Sher-E-Bangla Nagar, Dhaka

Muhammad Redwanul Haq
Product Development Lead , ICT / IoT Products
Grameen Phone Limited
Basundhara Residential Area, Dhaka-1229

Nayeem Ahmad
Managing Director and CEO
Ishraak Solutions Limited
Niketan, Gulshan 1, Dhaka

Dr. Rifat Shahriyar
Associate Professor
Department of Computer Science and Engineering (CSE)
Bangladesh University of Engineering and Technology (BUET)

Dr. Junaed Sattar
Assistant Professor
Department of Computer Science and Engineering (CSE)
University of Minnesot

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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:

<table>
<tr><th>Serial</th><th>Subjects</th><th>Syllabus</th><th>Marks</th></tr>
<tr><td>1</td><td>Mathematics</td><td rowspan="3">Syllabus of the current year of HSC Examinations of all Boards of Intermediate and Secondary Education</td><td>80</td></tr>
<tr><td>2</td><td>Physics</td><td>60</td></tr>
<tr><td>3</td><td>Chemistry</td><td>40</td></tr>
<tr><td>4</td><td>English</td><td>Comprehension and functional</td><td>20</td></tr>
<tr><td colspan="3">Total</td><td>200</td></tr>
</table>

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 10 July 2013 with a grade as "Good" and was renewed for three years in 2017.

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

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

2.3 Study Programs

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

2.3.1 CSE Program

2.3.1.1 Vision Statement

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

2.3.1.2 Mission of the Program

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

i. To provide high quality state of the art education and knowledge in Computer Science and Engineering, to produce competent engineers, capable of solving real-world problems to meet the needs of industry and society.

ii. To contribute towards the creation of new knowledge through eminence research and innovation in CSE and allied fields to address emerging national and global issues for well-being of the society.

iii. To enable students in attaining required ethics with an attitude of entrepreneurial skills, ethical values and social consciences.

iv. To embed leadership qualities amongst the students to follow successful professional career paths and to pursue advanced studies in computer engineering and a life-long learner in cutting edge developments in the field of computing and IT.

2.3.1.3 Program Educational Outcomes (PEOs)

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

1. Graduates will grow and develop in their chosen profession and/or progress toward an advanced degree by giving innovative solutions to complex problems.

2. Graduate will earn respects from others and demonstrate reliability as effective and ethical team members and achieve positions of leadership in an organization and/or on teams.

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

4. Graduates will be able 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.

Serial	PO	Category	Description
1	**PO1**	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO2**	**Problem Analysis**	Identify, formulate, research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO3**	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
4	**PO4**	**Investigation**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5	**PO5**	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**PO6**	**The Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, And cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO7**	**Environment and Sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need

			for sustainable development.
8	**PO8**	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO9**	**Individual and Team Work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO10**	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentation and give and receive clear instructions.
11	**PO11**	**Project management and Finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	**PO12**	**Lifelong learning**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Table: List of Program Outcomes

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).

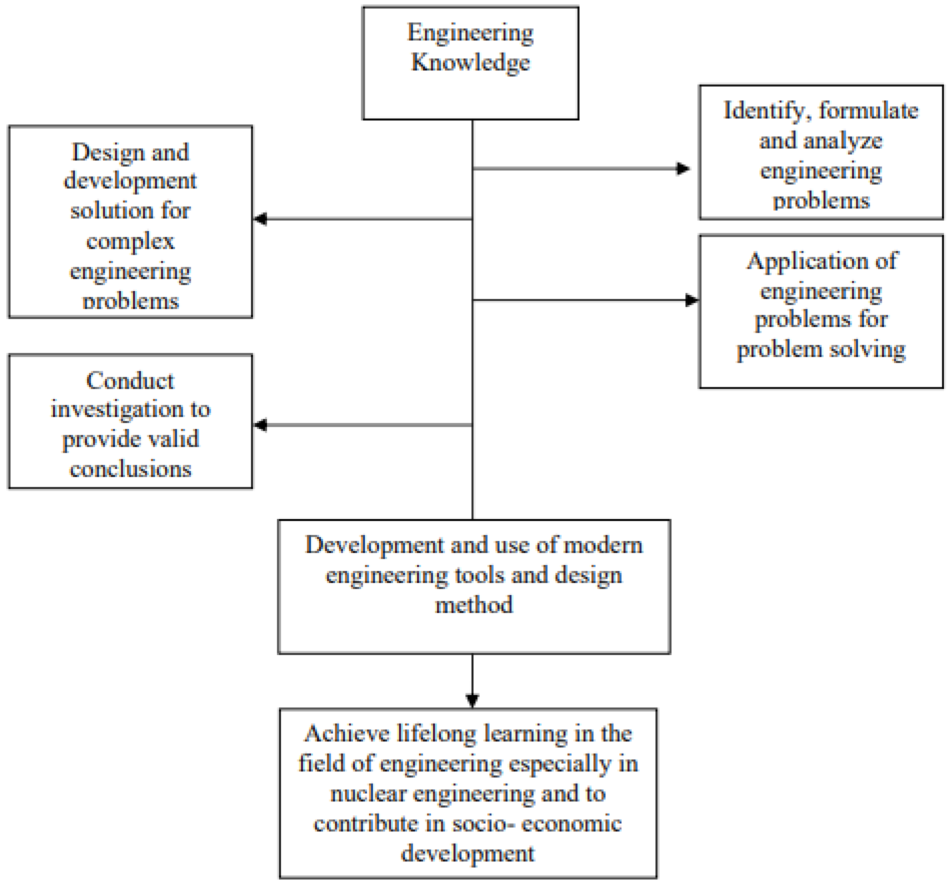
2.3.1.6 Generic Skills

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 Image Processing 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.

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 Under Construction:
The following labs are approved by Govt and CSe department is constructing them:

(1) Internet and Web Design Lab
(2) Data Base Design Lab
(3) Simulation and Modeling Lab
(4) Computing Lab

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

(1) HCI Lab
(2) VLSI Lab
(3) Big data and Cloud Computing Lab
(4) Software Defined Network (SDN) Lab
(5) Cyber Security Lab
(6) Digital Forensic 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

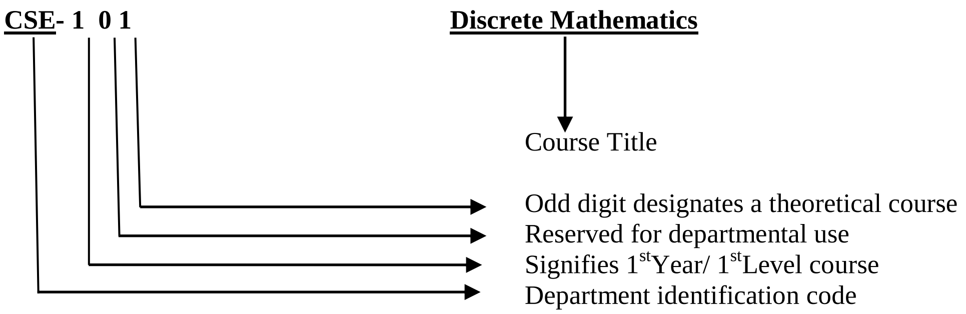
The undergraduate program is covered by a set of theoretical courses along with a set of laboratory (sessional) courses to support them.

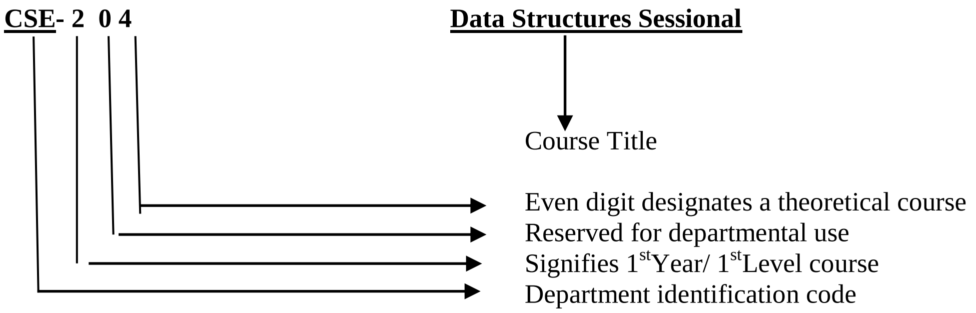
3.6 Course Designation System

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:





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. **Program Core:**

   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. **University Core**:

   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)	15%
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%

Note: *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

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

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**

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

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

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

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

	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	-	3.00	1.50	
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**	**7.50**	**20.75**	

LEVEL-1 FALL TERM

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-103	Digital Logic Design	3.00	-	3.00	
2.	CSE-104	Digital Logic Design Sessional	-	3.00	1.50	
3.	CSE-105	Structured Programming Language	3.00	-	3.00	
4.	CSE-106	Structured Programming Language Sessional	-	3.00	1.50	
5.	EECE-169	Electronic Devices and Circuits	3.00	-	3.00	EECE-163
6.	EECE-170	Electronic Devices and Circuits Sessional	-	1.50	0.75	
7.	ENG-102	Communicative English-I	-	3.00	1.50	
8.	MATH-105	Vector Analysis, Matrix and Coordinate Geometry	3.00	-	3.00	
9.	ME-122	Fundamental of Mechanical Engineering Sessional	-	4.00	2.00	
	Total		**12.00**	**13.50**	**19.25**	

LEVEL-2 SPRING TERM

	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.	ENG-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

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CE-250	Engineering Drawing and CAD Sessional	-	3.00	1.50	
2.	CSE-213	Computer Architecture	3.00	-	3.00	
3.	CSE-215	Data Structures and Algorithms-II	3.00	-	3.00	
4.	CSE-216	Data Structures and Algorithms-II Sessional	-	3.00	1.50	
5.	CSE-219	Mathematical Analysis for Computer Science	3.00	-	3.00	
6.	CSE-220	Object Oriented Programming Sessional-II	-	1.50	0.75	
7.	EECE-279	Digital Electronics and Pulse Technique	3.00	-	3.00	
8.	EECE-280	Digital Electronics and Pulse Technique Sessional	-	1.50	0.75	EECE-279
9.	GELM-275	Leadership and Management	2.00	-	2.00	
10.	MATH-207	Complex Variable and Statistics	3.00	-	3.00	MATH-101
	Total		**17.00**	**9.00**	**21.50**	**Total**

LEVEL-3 SPRING TERM

	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	
4.	CSE-304	Compiler Sessional	-	1.50	0.75	
5.	CSE-305	Microprocessors, Micro-controllers and Assembly Language	3.00	-	3.00	CSE-217
6.	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	-	3.00	1.50	
7.	CSE-307	Operating System	3.00	-	3.00	CSE-201
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

	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	CSE-319
7.	CSE-364	Software Development Project - I	-	3.00	1.50	
8.	GERM-352	Fundamentals of Research Methodology	-	4.00	2.00	
9.	GES-301	Fundamentals of Sociology	2.00	-	2.00	
10.	GESL-303	Environment, Sustainability and Law	2.00	-	2.00	
	Total		**12.00**	**13.00**	**18.50**	

***LEVEL-3 INDUSTRIAL TRAINING**

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

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

LEVEL-4 SPRING TERM

	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-429	Computer Security	3.00	-	3.00	
6.	CSE-464	Software Development Project-II	-	3.00	1.50	
7.	CSE-4XO	Technical Elective-I	3.00	-	3.00	
8.	GEEM-433	Engineering Ethics and Moral Philosophy	2.00	-	2.00	
	Total		**14.00**	**10.50**	**19.25**	

TECHNICAL ELECTIVE-I

	Course No	Course Title	Hours/Week		Credits	Pre-requisite
			Theory	Sessional		
1.	CSE-407	Applied Statistics and Queuing Theory	3.00	-	3.00	
2.	CSE-417	Blockchaining and Cryptocurrency Technology	3.00	-	3.00	
3.	CSE-419	Advanced Algorithms	3.00	-	3.00	
4.	CSE-421	Basic Graph Theory	3.00	-	3.00	
5.	CSE-423	Fault Tolerance System	3.00	-	3.00	
6.	CSE-425	Basic Multimedia Theory	3.00	-	3.00	
7.	CSE-427	Digital Image Processing	3.00	-	3.00	
8.	CSE-431	Object Oriented Software Engineering	3.00	-	3.00	
9.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00	-	3.00	
10.	CSE-435	Distributed Algorithms	3.00	-	3.00	
11.	CSE-437	Bioinformatics	3.00	-	3.00	
12.	CSE-439	Robotics	3.00	-	3.00	
13.	CSE-447	Telecommunication Engineering	3.00	-	3.00	

LEVEL-4 FALL TERM

	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-403	Artificial Intelligence	3.00	-	3.00	
4.	CSE-404	Artificial Intelligence 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**	

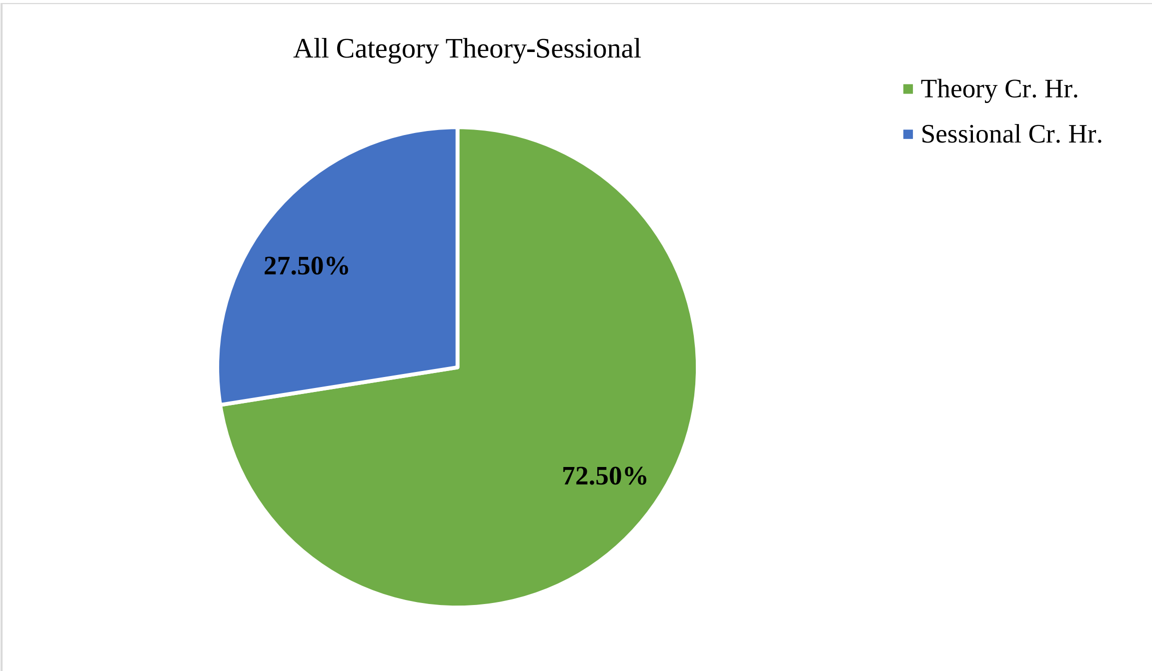
TECHNICAL ELECTIVE -II

	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

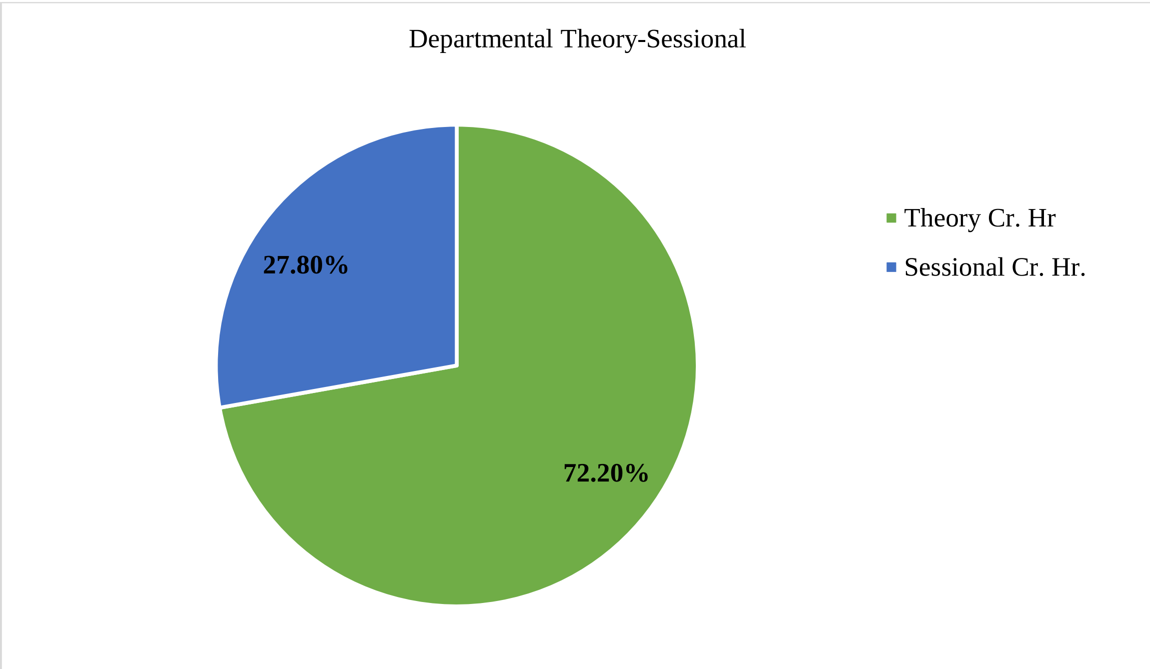
Summary of Departmental, Inter-disciplinary, Basic Science and Humanities Theory and Sessional Courses								
Level and Term	**Hours/Week**		**Total Cont. Hours**	**Credits**		**Total Credit**	**No of Courses**	
	Theory	**Sessional**		**Theory**	**Sessional**		**Theory**	**Sessional**
Level 1 Spring Term	17.00	7.50	24.50	17.00	3.75	20.75	6	3
Level 1 Fall Term	12.00	13.50	25.50	12.00	7.25	19.25	4	5
Level 2 Spring Term	15.00	10.50	25.50	15.00	5.25	20.25	5	4
Level 2 Fall Term	17.00	9.00	26.00	17.00	4.50	21.50	6	4
Level 3 Spring Term	15.00	10.50	25.50	15.00	5.25	20.25	5	5
Level 3 Fall Term	12.00	13.00	25.00	12.00	7.50	19.50	5	6
Level 4 Spring Term	14.00	10.50	24.50	14.00	5.25	19.25	5	3
Level 4 Fall Term	14.00	10.50	24.50	14.00	5.25	19.25	5	4
Grand Total	**116.00**	**85.00**	**201.00**	**116.00**	**44.00**	**160.00**	**41**	**34**

Pie Chart



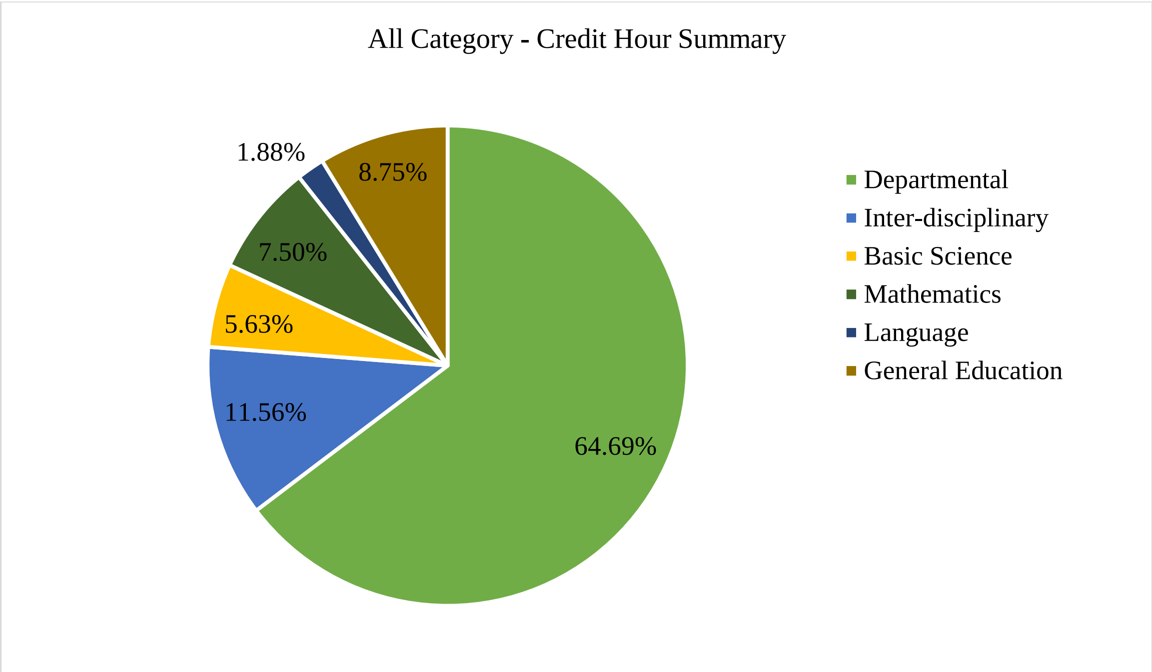
Summary of Departmental Theory and Sessional Courses			
Level/ Term	**Theory Cr. Hr.**	**Sessional Cr. Hr.**	**Total Cr. Hr.**
Level-1 Spring Term	3.00	0.00	3.00
Level-1 Fall Term	6.00	3.00	9.00
Level-2 Spring Term	9.00	3.00	12.00
Level-2 Fall Term	9.00	2.25	11.25
Level-3 Spring Term	15.00	5.25	20.25
Level-3 Fall Term	8.00	4.50	12.50
Level-4 Spring Term	12.00	5.25	17.25
Level-4 Fall Term	12.00	5.25	17.25
Total	**74.00**	**28.50**	**102.50**

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	3.00	3.75	9.00	3.00	-	2.00	20.75
Level 1 Fall Term	9.00	5.75	-	3.00	1.50	-	19.25
Level 2 Spring Term	12.00	3.75	-	3.00	1.50	-	20.25
Level 2 Fall Term	11.25	5.25	-	3.00	-	2.00	21.50
Level 3 Spring Term	20.25	-	-	-	-	-	20.25
Level 3 Fall Term	13.5	-	-	-	-	6.00	19.50
Level 4 Spring Term	17.25	-	-	-	-	2.00	19.25
Level 4 Fall Term	17.25	-	-	-	-	2.00	19.25
Total	**103.50**	**18.50**	**9.00**	**12.00**	**3.00**	**14.00**	**160.00**

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,A2	1,2		1	T, ASG, Viva
CO2	Construct simple mathematical proofs and possess the ability to verify them.	C2,C3	1		1,2	T
CO3	Demonstrate the understanding of sets, relations and functions and modeling problems using graphs and trees.	C2-C3	1		1-3	Mid Term, F
CO4	Develop the communication skills by presenting different topics on graphs and trees.	A2		1		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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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									
CO4	Develop the communication skill by presenting different topics on graphs and trees.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	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-PO2	High	Develop the ability to evaluate a proof on the basic structure of each proof technique described.
CO3-PO3	High	Be able to specify and manipulate basic mathematical objects such as sets, functions, and relations and will also be able to verify simple mathematical properties that these objects possess.
CO4-PO10	Low	Develop the communication skill through class participation and 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

Lectures, class performance, Quiz, Viva, Lab tests, Report

COURSE SCHEDULE

Week	**Lecture**	**Topics**	**Assessment Methods**
1	Lec 1 Lec 2 Lec 3	The Foundations: Logic, Propositional Equivalence	
2	Lec 4	The Foundations: Predicates and Quantifiers,	

	Lec 5 Lec 6	Nested Quantifiers	Class Test 1
3	Lec 7 Lec 8 Lec 9	The Foundations: Methods of Proofs	
4	Lec 10 Lec 11 Lec 12	The Foundations: Sets, Set Operations, Functions	Class Test 2
5	Lec 13 Lec 14 Lec 15	The Fundamentals: Algorithms, Integers and Division	
6	Lec 16 Lec 17 Lec 18	The Fundamentals: Integers and Algorithms	
7	Lec 19 Lec 20 Lec 21	Mathematical Reasoning, Induction and Recursion: Mathematical Induction	
8	Lec 22 Lec 23 Lec 24	Mathematical Reasoning, Induction and Recursion: Recursive Definitions and Structural Induction	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	20%	CO1	C1, C2,P3,A1
			CO2	C2,C3
	Class Participation	5%	CO4	C6,A2
	Mid term	15%	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. 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		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	3		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		2	T, F, MT, ASG
CO4	**Develop** the communication skill by presenting topics on operating systems.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-PO1	High	The theory-based knowledge of the natural sciences applicable to the engineering discipline.
CO3-PO1	High	The numerical analysis-based knowledge of the natural sciences applicable to the engineering.
CO4-PO10	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	Topics	Assessment Methods
Week 1	**Atomic Structure**	
Class 1	Concepts of atomic structure, Different atom models	Class Test-1
Class 2	Concepts of atomic structure, Different atom models	
Class 3	Quantum numbers, Electronic configuration	
Week 2	**Atomic Structure/Periodic Table**	
Class 4	Hydrogen spectral lines, Heisenberg's uncertainty principle	
Class 5	Classification of elements according to electronic configurations	
Class 6	Periodic classification of elements	
Week 3	**Periodic Table/Chemical Bonding**	
Class 7	Periodic properties of elements, Properties and uses of noble gases	
Class 8	Alkali metals: Chemical properties and uses	
Class 9	Chemical bonding (types, properties, Lewis theory, VBT)	
Week 4	**Chemical Bonding**	Class Test-2
Class 10	Molecular orbital theory (MOT)	
Class 11	Molecular orbital theory (MOT)	
Class 12	Hybridization and shapes of molecules	
Week 5	**Chemical Bonding/Organic Chemistry**	
Class 13	Hybridization and shapes of molecules	
Class 14	Hybridization and shapes of molecules	
Class 15	Basic concepts of organic chemistry: History, Physical & chemical properties, Classification	
Week 6	**Organic Chemistry**	
Class 16	Chemistry of hydrocarbon, Nomenclature, Properties	
Class 17	Selective organic reactions: Oxidation-reduction, Substitution	
Class 18	Selective organic reactions: Addition, Polymerization, Alkylation	
Week 7	**Acids-Bases**	Mid Term Exam
Class 19	Different concepts of acids-bases	
Class 20	Buffer solution, Mechanism of buffer solution	
Class 21	Henderson-Hasselbalch equation	
Week 8	**Acids-Bases/Solutions**	
Class 22	Water chemistry and pH of water	
Class 23	Solutions and their classification, Unit expressing concentration	
Class 24	Effect of temperature and pressure on solubility, Validity and limitations of Henry’s law	
Week 9	**Solutions/Thermochemistry**	
Class 25	Colligative properties and dilute solutions, Raoult’s law, deviation from Raoult’s law, Elevation of boiling point	

Class 26	Freezing point depression, Van't Hoff's law of osmotic pressure	
Class 27	Thermochemistry: Laws of thermochemistry, Enthalpy	
Week 10	**Thermochemistry/Electrochemistry**	
Class 28	Hess's law, Kirchoff's equations	
Class 29	Heat of formation, Heat of neutralization, Heat of reaction	
Class 30	Electrolytic conduction and its mechanism	
Week 11	**Electrochemistry**	Class TestT-**3**
Class 31	Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory	
Class 32	Conductrometric titrations	
Class 33	Different types of cells	
Week 12	**Chemical Equilibrium**	
Class 34	Reversible reactions, Characteristics of chemical equilibrium, Law of mass action, Equilibrium constant, Units of equilibrium constant	
Class 35	Relation between Kp & Kc,Van't Hoff's reaction isotherm	
Class 36	Free energy and its significance Heterogeneous equilibrium, Le Chatelier's principle	
Week 13	**Phase Rule/Chemical Kinetics**	
Class 37	Phase Rule: Basic terms and phase rule derivation	
Class 38	Phase Diagram of water and carbon dioxide	
Class 39	Pseudo and zero order reaction, Half-life	
Week 14	**Chemical Kinetics**	
Class 40	Determination and factors affecting the rate of a reaction	
Class 41	First order reaction, Second order reaction	
Class 42	Collision theory, Transition state theory	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO2	C2
	Class Participation	5%	CO4	A2
	Mid term	15%	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 Course Title	: CHEM-102 : Chemistry Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50
PRE-REQUISITE			
Course Code: CHEM-101 Course Title: Funamentals of Chemistry			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
RATIONALE			
This course is a laboratory course for the basic chemistry in the field of inorganic and physical chemistry. The course will be emphasized by fundamental experiments on different fields of chemistry which can be applicable in a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic chemistry practically as well as do work with team or individual.			
OBJECTIVE			
1. To develop basic chemistry knowledge practically 2. To practice the 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 inorganic and physical chemistry.	C1	1		1	Q
CO2	**Estimate** zinc, ferrous content in water samples by using various titrimetric methods.	C1	1		1	T
CO3	**Construct** Experiments by an individual or by a group to determine different phenomena regarding acid-base, iodoiodimetric, complexometric and redox titration etc	C3	1		2	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; F – Final Exam, MT- Midterm Exam)

COURSE CONTENT

Standardization: Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution, Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution, Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na2CO3) Solution, Standardization of Sodium Thiosulphate Pentahydrate (Na2S2O3.5H2O) Solution with Standard Potassium Dichromate (K2Cr2O7) Solution, Standardization of Potassium Permanganate (KMnO4) Solution with Standard Oxalic Acid dihydrate (C2H2O4.2H2O) Solution; **Determination:** Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate (CaCl2.2H2O) Solution with Standard Di-Sodium Ethylene Diamine Tetra Acetic acid (Na2-EDTA) Solution, Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate (Mohr`s Salt) [$FeSO_4.(NH_4)_2SO_4.6H_2O$] Solution with Standard Potassium Permanganate ($KMnO_4$) Solution, Determination of Zinc (Zn) Content in a Zinc Sulphate Heptahydrate (ZnSO4.7H2O) Solution with Standard Di-Sodium Ethylene Diamine TetraAcetic acid (Na2-EDTA) Solution by using Eriochrome black T indicator; **Estimation:** Estimation of Copper (Cu) Content in a Copper Sulphate Pentahydrate (CuSO4.5H2O) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium Thiosulphate Pentahydrate (Na2S2O3.5H2O) Solution.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Define** the different parameters regarding inorganic and physical chemistry.	H											
CO2	**Estimate** zinc, ferrous content in water samples by using various titrimetric methods.	H											
CO3	**Construct** Experiments by an individual or by a group to determine different phenomena regarding acid-base, iodoiodimetric, complexometric and redox titration etc									M			
CO4	**Prepare** a report for an experimental work										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-PO1	High	The descriptive knowledge of the natural sciences applicable to the engineering discipline
CO3-PO9	Medium	Able to do work or complete a task as an individual and as a team.
CO4-PO10	Low	Capable to write a report on an experimental work.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	12
Practical / Tutorial / Studio	18
Student-Centred Learning	-
Self-Directed Learning	
Preparation of Lab Reports	18
Preparation of Lab-test	25
Preparation of Quiz	9
Preparation of viva	9
Formal Assessment	
Continuous Assessment	2
Quiz	1
Final Examination	3
Total	95

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics
1	Lab 1	Introduction
2	Lab 2	Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate (C2H2O4.2H2O) Solution.
3	Lab 3	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.
4	Lab 4	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na2CO3) Solution.
5	Lab 5	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate (CaCl2.2H2O) Solution with Standard Di-Sodium Ethylene Diammine Tetra Acetic Acid (Na_2-EDTA) Solution.

6	Lab 6	Standardization of Sodium Thiosulphate Pentahydrate (Na2S2O3.5H2O) Solution with Standard Potassium Dichromate (K2Cr2O7) Solution.
7	Lab 7	Estimation of Copper (Cu) Content in a Copper Sulphate Pentahydrate (CuSO4.5H2O) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium Thiosulphate Pentahydrate (Na2S2O3.5H2O) Solution.
8	Lab 8	Standardization of Potassium Permanganate (KMnO4) Solution with Standard Oxalic Acid dihydrate (C2H2O4.2H2O) Solution.
9	Lab 9	Standardization of Potassium Permanganate (KMnO4) Solution with Standard Oxalic Acid dihydrate (C2H2O4.2H2O) Solution.
10	Lab 10	Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate (Mohr`s Salt) [FeSO4.(NH4)2SO4.6H2O] Solution with Standard Potassium Permanganate (KMnO4) Solution.
11	Lab 11	Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate (Mohr`s Salt) [FeSO4.(NH4)2SO4.6H2O] Solution with Standard Potassium Permanganate (KMnO4) Solution.
12	Lab 12	Determination of Zinc (Zn) Content in a Zinc Sulphate Heptahydrate (ZnSO4.7H2O) Solution with Standard Di-Sodium Ethylene Diamine Tetra Acetic acid (Na_2-EDTA) (Na2-EDTA) Solution by using Eriochrome black T indicator.
13	Lab 13	Determination of Zinc (Zn) Content in a Zinc Sulphate Heptahydrate (ZnSO4.7H2O) Solution with Standard Di-Sodium Ethylene Diamine TetraAcetic acid (Na_2-EDTA) (Na2-EDTA).
14	Lab 14	Determination of Zinc (Zn) Content in a Zinc Sulphate Heptahydrate (ZnSO4.7H2O) Solution by using Eriochrome black T indicator.

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Performance	10%	CO1	C1
	Report writing	30%	CO4	C2
Final Exam (60%)	Lab Test	30%	CO1, CO2, CO3	C1, C3
	Viva	10%		
	Quiz	20%		
Total Marks		100%		

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

REFERENCE BOOKS

1. Practical Chemistry - A Jabbar & M Haque
2. Quantitative Chemical Analysis - A I Vogel
3. Analytical chemistry - Gary D. Christian

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	Capable to **interpret** circuit laws and **apply** their corresponding technique to find circuit quantities; also **justify selection** particular circuit concept(s) and theorem(s) for simplifying complex circuits.	C5	1		3	T, F
CO2	Competent in **analyse** 1st and 2nd-order circuits and **evaluate** the responses both in the presence and absence of dc circuits.	C4	1		2,3	T, MT
CO3	Manage to **outline** sinusoids and phasors in **explaining** circuit parameters and **analysing** AC power.	C2	-		1	F,MT
CO4	Able to **understand** the current voltage relation of 3 phase circuits for different configure-tions and **reproduce** knowledge of AC power to **analyze** real life power consumptions of transmission lines.	C2	1		3,5	F, 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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Capable to **interpret** circuit laws and **apply** their corresponding technique to find circuit quantities; also **justify selection** particular circuit concept(s) and theorem(s) for simplifying complex circuits.	H											
CO2	Competent in **analyse** 1st and 2nd-order circuits and **evaluate** the responses both in the presence and absence of dc circuits.	M											
CO3	Manage to **outline** sinusoids and phasors in **explaining** circuit parameters and **analysing** AC power.	M											
CO4	Able to **understand** the current voltage relation of 3 phase circuits for different configure-tions and **reproduce** knowledge of AC power to **analyze** real life power consumptions of transmission lines.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Problem analysis capability must be present in order to come to circuit solutions.
CO2-PO1	Medium	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-PO1	Medium	The knowledge of mathematics, science and electrical engineering scienceshas to be applied to describeSinusoids and phasors along with AC power.
CO4-PO3	Medium	Investigative capability is a must in analysing 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	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	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+Pr
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	C5
			CO2	C4
	Class	5%	CO4	C2

	Participation			
	Mid term	15%	CO2, CO3	C2, C4
Final Exam		60%	CO1	C5
			CO3	C2
			CO4	C2
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	**Assemble** electrical circuits that can **verify** fundamental electrical laws (KVL, KCL and Ohm's Law)	P5, A3	1		1,2,3	R, Q, T
CO2	**Set up** circuits to **justify** Thevenin's law and Norton's law in electrical circuits.	P5, A3	1		1,2,3	R, Q, T
CO3	**Produce** desired ac waves and **measure** amplitude and phase of ac waves in oscilloscope, **design** analogue RLC filter that can produce desired frequency response.	P6	1		1,2	R, Q, T
CO4	Develop collaborating nature by **completing** a simple project in both software and hardware and **performing** group activities.	P7, A4	2	1	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Assemble** electrical circuits that can **verify** fundamental electrical laws (KVL, KCL and Ohm's Law)									H			
CO2	**Set up** circuits to **justify** Thevenin's law and Norton's law in electrical circuits.										H		
CO3	**Produce** desired ac waves and **measure** amplitude and phase of ac waves in oscilloscope, **design** analogue RLC filter that can produce desired frequency response.					H							
CO4	Develop collaborating nature by **completing** a simple project in both software and hardware and **performing** group activities.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO9	High	Assembling electrical circuits on Hardware level require teamwork and individual work since experiments are done in groups.
CO2-PO10	High	Preparing lab reports on verification of Thevenin's and Norton's theorem require documentation and effective report writing skill.
CO3-PO5	High	Producing and measuring ac signals and quantities needs knowledge of operation of digital oscilloscope which can be considered a modern engineering tool.
CO4-PO9	High	Developing communication through participating group works, presentation and viva.

TEACHING LEARNING STRATEGY

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

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

TEACHING METHODOLOGY

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

COURSE SCHEDULE

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

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (75%)	Lab participation and Report	20%	CO1	P5, A3
			CO2	P5, A3
			CO3	P6
			CO4	P7, A4
	Labtest-1 ,Labtest-2	30%	CO1	P5, A3
			CO2	P5, A3
			CO3	P6
			CO4	P7, A4
	Project and Presentation	25%	CO4	P7, A4
Lab Quiz		25%	CO1	P5, A3
			CO2	P5, A3
			CO3	P6
			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, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.	C1-C2	-	-	-	T, MT, F
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		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- 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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- PO6	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- PO6	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-PO10	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	Introductory class: Brief discussion on the total syllabus, basic requirements of the course, methods of assessment of the course	Class Test-1
	Lec-2	<u>Bangladesh Geography:</u> Location, Area, Boundary, Physiography, River System, Forest and Climate, Demography of Bangladesh.	
2	Lec-3	Overview of the ancient Bengal; anthropological identity of	

	Lec-4	the Bengali race; main trends in the history of medieval Bengal	
		Bengal under the East India Company,	
3	Lec-5	Religious and Social reform movements	
	Lec-6	Nationalist movements, division of the Indian sub-continent	
4	Lec-7 Lec-8	Language movement 1948-1952, Education movement of 1962	Mid Term Exam
		Language movement 1948-1952, Education movement of 1962	
5	Lec-9	Six-point movement of 1966; Mass uprising of 1969;	
	Lec-10	War of Independence and Emergence of Bangladesh in 1971	
6	Lec-11	Constitution of Bangladesh	
	Lec-12	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	Minerals, Health and Education,	
	Lec-18	Agriculture, Industries	
10	Lec-19 Lec-20	NGOs, Population, Sociological and Cultural aspects of Bangladesh	Class Test-2
		Economy and national development,	
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	Art and Literature	
	Lec-24	Traditional cultural events	
13	Lec-25	Vision-2021, Digitalization	
	Lec-26	Tourism and Natural Resources	
14	Lec-27	Bangladesh and International Relations	
	Lec-28	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
	Mid term	15%	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	: MATH-101	Lecture Contact Hours	: 3.00
Course Title	: Differential and Integral Calculus	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 basic knowledge of Differential Calculus and use it in engineering study.

OBJECTIVE

1. To impart basic knowledge on differential and Integral Calculus to solve engineering problems and other applied problems.
2. To develop understanding some of the important aspects of rate of change, area, tangent, normal and volume.
3. To be expert in imparting in depth 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** the limit, continuity and differentiability of functions, **identify** the rate of change of a function with respect to independent variables and **describe** the different techniques of evaluating indefinite and definite integrals.	C1-C2	1		3	T, F, ASG
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	C3	1		3	T, MT, F
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study	C3	1		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, Function and Limit, Continuity and Differentiability, Successive Differentiation, Leibnittz's Theorem, Rolle's Theorem, Mean Value Theorem, Taylor's theorem, Expansion of Finite and Infinite forms, Lagrange's form of remainder, Cauchy's form of remainder, Expansion of functions differentiation and integration, Indeterminate form, Cartesian differentiation, Euler's theorem, Tangent, sub tangent and Normal, sub normal, Maxima and Minima, Curvature, Asymptotes, Partial differentiation. **Integral Calculus:** Definition of Integration, Importance of Integration in Eng., Integration by substitution, Integration by parts, Standard integrals, Integration by successive reduction, Definite integrals and its use, Integration as a limit of sum, summing series, Walli's formula, Improper Integrals, beta and gamma function, multiple integral and its application, Area, volume of solid revolution, Area under a plain curve, Area of the region enclosed by two curves, Arc lengths of curves.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Define** the limit, continuity and differentiability of functions, **identify** the rate of change of a function with respect to independent variables and **describe** the different techniques of evaluating indefinite and definite integrals	H											
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	H											
CO3	**Calculate** the length, area, volume, center of gravity and average value related to engineering study	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	The knowledge of mathematics, science and engineering has to be applied to describe the complete concept of differential and integral calculus.
CO2-PO1	High	To apply proper and improper integral in the field of engineering study, the knowledge of mathematics, science and engineering is required.
CO3-PO1	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	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 Differential Calculus for Engineering study, Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
2	Lec 4 Lec 5 Lec 6	Basic concept of Differentiability, definition, derivative of a function, differentiable function, Differentiability – one sided derivatives, Successive differentiation	Class Test 1
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	Expansion of finite and infinite forms, Lagrange's and Cauchy's form of remainder, Indeterminate forms – concept and problem solving, L'Hospital's rules with application	
5	Lec 13 Lec 14 Lec 15	Partial differentiation - partial derivatives of a function of two/ several variables and problems, Euler's theorem for several (two, three and m) variables and problem solving	
6	Lec 16 Lec 17 Lec 18	Tangents and Normals in Cartesian, equation of tangent ans sub tangents at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	Class Test 2
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	
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	Mid Term Exam
10	Lec 31 Lec 32 Lec 33	Definite integrals – Reduction formula, Walli's formula, definite integral as the limit of the sum, Beta function – concept and problem solving	
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, successive integration for two and three variables, Area in Cartesian	
13	Lec 37 Lec 38 Lec 39	Area in polar, Volume of solid revolution, Area under a plain curve in Cartesian and polar coordinates	Class Test 3
14	Lec 40 Lec 41 Lec 42	Area of a region enclosed by two curves in Cartesian and polar coordinates, Arc lengths of curves in Cartesian and polar coordinates	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1, CO2	C1, C2
			CO 2	C3
	Class Participation	5%	CO 3	C3
	Mid term	15%	CO 2, CO3	C3
Final Exam		60%	CO1	C1, C2
			CO2	C3
			CO3	C3
Total Marks		100%		

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

REFERENCE BOOKS

1. Calculus (9th) - Howard Anton, Irl C. Bivens (Author), Stephen Davis.
2. Calculus: An Intuitive and Physical Approach (2nd)-Morris Kline.

REFERENCE SITE

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

COURSE INFORMATION

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

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to teach the basic physics in the field of Waves and Oscillations, Optics and Modern physics. The course will be emphasized basic concepts, theories and solve quantitative problems which can be applicable in a wide spectrum of engineering disciplines.

OBJECTIVE

1. To define the different parameter and concepts of Waves and Oscillations, Optics and Modern physics.
2. To explain the basic concepts of Waves and Oscillations, Optics and Modern physics.
3. To solve 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 parameters in the field of Waves and Oscillations, Optics and Modern physics such as periodic motion, simple harmonic motion, undamped oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model, radioactive decay, fusion,	C1	1		1	T, F, MT

	fission etc.					
CO2	**Explain** different basic theories in the field of Waves and Oscillations, Optics and Modern physics such as the wave motion for different systems along with energy, different formula for interference, diffraction, polarization special theory of relativity, Compton theory, nuclear transformation, and nuclear reaction etc.	C1	1		1	MT, F
CO3	**Solve** quantitative problems in the field of Waves and Oscillations, Optics and Modern physics such as energy of wave motion, wavelength, diffraction pattern, relativistic energy, photon energy, Compton shift, nuclear binding energy etc.	C2	2		2	T, MT, F, ASG
CO4	**Develop** the communication skill by presenting topics on computer graphics.	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

Waves and Oscillations: Simple Harmonic Motion (SHM) and its properties, Differential equation of a SHM and its solution, total energy of a body executing SHM, average kinetic and potential energy of a body executing SHM, LC oscillatory circuit; Pendulum- simple, compound and torsional pendulum, spring-mass system, two body oscillation and reduced mass, damped harmonic motion and its different condition, forced oscillation and its different condition, resonance, equation of a progressive wave, differential equation of a progressive wave, energy density of wave motion, average kinetic and potential energy of a body executing SHM, Stationary wave.

Optics: Lens, equivalent lens and power, defects of images and different aberrations, Interference of light, Young's double slit experiment, Interference in thin film and Newton's ring method, diffraction of light, diffraction by single slit, diffraction by double slits, Fraunhofer and Fresnel bi-prism, diffraction gratings, polarization of light, Brewster's law, Malus law, polarization by double refraction Nicole prism, optical activity and polarimeters, optical instruments, resolving power of optical instrument, Laser: spontaneous and stimulated emission

Modern Physics: Galilean relativity & Reference frame, Special theory of relativity postulates, 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 nucleus, nuclear binding energy, radioactivity, radioactive decay law, half-life, mean life, nuclear reaction, introduction to nuclear reactor.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	H											

	Modern physics.												
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-PO1	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-PO1	High	The theory-based knowledge of the natural sciences applicable to the engineering discipline.
CO3-PO1	High	The numerical analysis-based knowledge of the natural sciences applicable to the engineering.
CO4-P10	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	Simple harmonic motion (SHM) and its differential equations, graphical representation of SHM, Average K.E and total energy	Class Test 1
2	Lec 4 Lec 5 Lec 6	Spring-mass system, electric oscillatory circuit, Simple, compound and torsional pendulum, Combination of two SHM	
3	Lec 7 Lec 8 Lec 9	Combination of two SHM, Two body oscillations, reduced mass, Damped oscillations and its differential equation	
4	Lec 10 Lec 11 Lec 12	Displacement equation of damped oscillation, electric damped oscillatory circuit, Forced oscillation and its differential equation, displacement equation of forced oscillation, resonance	Class Test 2
5	Lec 13 Lec 14 Lec 15	Plane progressive wave, energy density of wave, Stationary wave, Lens and combination of lenses, power of lens	
6	Lec 16 Lec 17 Lec 18	Defects of images and different aberrations, Interference of light, young's double slit experiment	
7	Lec 19 Lec 20	Interference in Thin films, Newton's ring, Fresnel & Fraunhofer diffraction, Diffraction by single slit	

	Lec 21		
8	Lec 22 Lec 23 Lec 24	Diffraction by double slit, Diffraction gratings, Polarization and Production and analysis of polarized light, Optics of crystals, Nicole prism	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Brewster's and Malus law, Optical activity and polarimeter, Laser & its applications	
10	Lec 31 Lec 32 Lec 33	Frame of Reference, Postulates of special relativity, Galilean Transformation, Lorentz Transformations, Length Contraction and Time dilation	
11	Lec 28 Lec 29 Lec 30	Mass and Energy equivalence equation and concept of Massless particle and its expression, Photoelectric Effect, photocurrent and work function, kinetic energy, stopping potential	Class Test 3
12	Lec 34 Lec 35 Lec 36	Definition, Compton wavelength shift, limitation, De Broglie Concept, Condition for wave and particle behavior, Bohr atomic model, expression for Bohr radii and orbital energy for hydrogen atom	
13	Lec 37 Lec 38 Lec 39	Classification of Nucleus, nuclear binding energy, Radioactivity and its transformation, Radioactive Decay Law, half-life, mean life, nuclear reaction	
14	Lec 40 Lec 41 Lec 42	Concept of Fusion, Fission and nuclear chain reaction, General idea on nuclear reactor and nuclear power plant	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO2	C1
			CO3	C2
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C1
			CO3	C2
Final Exam		60%	CO1	C1
			CO2	C1
			CO3	C2
Total Marks		100%		

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

REFERENCE BOOKS

1. Fundamentals of Physics (10th) - Halliday, Resnick and Walker
2. Physics for Scientists and Engineers(9th) - Serway and Jewett
3. Concept of Modern Physics (6th) - Arthur Beiser
4. University Physics with Modern Physics (14th) - Hugh D. Young and Roger A. Freedman
5. Modern Physics for Science and Engineering - Marshall L. Burns
6. Waves and Oscillations - Walter Fox Smith
7. The Physics of Vibrations and Waves - H. J. Pain
8. Waves and Oscillations (2nd)- BrijLal and Subramannyam
9. Fundamental of Optics - Francis A. Jenkins and Harvey E.White
10. Introduction to Modern Optics - Grant R. Fowles
11. Fundamental Optical Design - Michael J. Kidger

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 course is a laboratory course for the basic physics in the field of Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics. The course will be emphasized fundamental experiments on different fields of physics which can be applicable in a wide spectrum of engineering disciplines. This laboratory course will enable students to understand basic physics practically as well as do work with 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		1	Q
CO2	**Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	C1	1		1	T, F
CO3	**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.	C3	1		2	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; F – Final Exam, MT- Mid Term Exam, Viva – V, Experimental Exam – EE, Class performance)

COURSE CONTENT
In this course, students will perform experiments to practically verify the theories and concepts learned in PHY-101.
SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	**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.									M			
CO4	**Prepare** a report for an experimental work.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	The conceptual knowledge of the natural sciences applicable to the engineering discipline.
CO2-PO1	High	The descriptive knowledge of the natural sciences applicable to the engineering discipline.
CO3-PO9	Medium	Able to do work or complete a task as an individual and as a team.
CO4-PO10	Low	Capable to write a report on an experimental work.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	12
Practical / Tutorial / Studio	18
Student-Centred Learning	-
Self-Directed Learning	
Preparation of Lab Reports	18
Preparation of Lab-test	25
Preparation of Quiz	9
Preparation of viva	9
Continuous Assessment	2
Quiz	1
Final lab exam	3
Total	95

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics
1	**Lab 1**	Introductory class: Brief discussion on total syllabus, basic requirements of the course.
2	**Lab 2**	Evaluation system of the course, grouping, visit different section of the laboratory, introduction to different basic equipment’s.
3	**Lab 3**	Determination of specific resistance of materials of a wire by using Meter Bridge.
4	**Lab 4**	Determination of focal length of a concave lens by auxiliary lens method.
5	**Lab 5**	Determination of a high resistance by the method of deflection/ Determination of specific heat of a liquid by the method of cooling
6	**Lab 6**	Determination of ECE of copper by using copper voltameter / Determination of the Young’s modulus of bar by bending method
7	**Lab 7**	Determination of the wavelength of light by using diffraction grating
8	**Lab 8**	Determination of the focal length of a plano-convex lens by Newton’s ring method
9	**Lab 9**	Determination of the specific rotation of sugar by poralimeter
10	**Lab 10**	Determination of the conductivity of a bad conductor by Lee’s method
11	**Lab 11**	Verification of the law of conservation of linear momentum
12	**Lab 12**	Determination of the acceleration due to gravity by means of compound pendulum

13	**Lab 13**	Determination of the spring constant and the rigidity modulus of a spiral spring
14	**Lab 14**	Determination of the Planck's constant using photoelectric effect

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class performance	10%	CO1	C1
	Report Writing	30%	CO4	C2
Final Exam (60%)	Lab Test	30%	CO1, CO2, CO3	C1, C3
	Viva	10%		
	Quiz	20%		
Total Marks		100%		

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

REFERENCE BOOKS

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

REFERENCE SITE

LEVEL-1 FALL TERM

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 (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Remember and understand the number system and Boolean algebra and basic properties of Boolean algebra to simplify simple Boolean functions.	C1-C2,P3,A1	1		1, 2	T
CO2	Understanding and applying the tabulation and Karnaugh map methods for simplifying combinational circuits.	C2,C3	1,2		1,3	T
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		1-3	MT, F
CO4	Design and develop different digital systems like shifters, counters, registers by presenting in front of the class.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Remember and understand the number system and Boolean algebra and basic properties of Boolean algebra to simplify simple Boolean functions.	H											
CO2	Understanding and applying the tabulation and Karnaugh map methods for simplifying combinational circuits.		H										
CO3	Identify the basic sequential logic components: SR Latch, Different Flip-Flops and their usage and able to analyze sequential logic circuits..		H										
CO4	Design and develop different digital systems like shifters, counters, registers by presenting in front of the class										L		

(H–High, M–Medium, L–Low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	High	Applying the knowledge of different number systems, postulates and theorems of boolean algebra to the solution Boolean functions.
CO2-PO2	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-PO2	High	To solve digital circuits, need to know and analyze which components like flip-flops, encoder/decoder, multiplexer, PLA, counter etc will be better.
CO4-PO10	Low	Able to develop communication skill through effective class presentation by presenting the design of respective digital 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
	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 Lec 39	Pulse mode logic; Fundamental mode design	
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 Participation	5%	CO4	C6,A2
	Mid term	15%	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

REFERENCE SITE

CSE-104: Digital Logic Design Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-104 : Digital Logic Design 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 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

1. To gain basic knowledge on logic design and the basic building blocks used in digital systems, in particular digital computers.
2. 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		1,2	1	Viva, Q, R
CO2	Analyse a given problem and apply the acquired knowledge to design both combinational and sequential circuits.	C3-C5		3	5	Viva, LT, R
CO3	Understand the relationship between abstract logic characterizations and practical implementations while designing a system.	C4-C6		1-3	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	High	Able to apply knowledge of different number systems, postulates and theorems of boolean algebra to simplify and design digital circuits.
CO2-PO2	High	Able to analysis a given problem and solving the problem by implementing different basic gates.
CO3-PO3	High	Able to design and implement a complete combinational/sequential digital circuit using different gates and ICs.
CO3-PO10	High	Group work and viva will increase the communication skill of individuals.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	-
Practical / Tutorial / Studio	42
Viva	-
Self-Directed Learning	
Report	14
Revision	-
Assessment Preparations	2
Formal Assessment	
Lab Test	3 X 2=6
Total	64

TEACHING METHODOLOGY

Lectures, class performance, Quiz, Viva, Lab tests, Report

COURSE SCHEDULE

Week	**Topics**	**Remarks**
1	Verify Basic Logic Gates and Truth Tables of the Logic Gates	
2	Combinational Circuit (Light Your Lamp)	
3	Experiments Based on Truth tables and Boolean functions	
4	Experiments Based on Truth tables and K-maps	

5	Design and implementation of the Logic Circuits using K-maps (7 Segment Display)	
6	Experiments Based on Adder/Subtractor	
7	Experiment based in real life examples	
8	Experiments Based on Comparator	
9	Design and implementation of Combinational circuit using Multiplexer	
10	Design and Implementation of encoder and decoder	
11	Design and implement Flip Flop using basic gates	
12	Design and implement counters using Flip-Flops	
13	Design and implement counters, registers using Flip-Flops	
14	Experiments based on real life example	

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Lab Test	40%	CO2	C3-C5
		CO3	C4-C6
Quiz	20%	CO1	C2, A2
Viva	10%	CO1	C2, A2
		CO2	C3-C5
		CO3	C4-C6
Class Performance	20%	CO2	C3-C5
		CO3	C4-C6
Report	10%	CO1	C2, A2
		CO2	C3-C5
		CO3	C4-C6
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 Manno
2. Digital Computer Electronics by Albert P. Malvino, Jerald A Brown

REFERENCE SITE

CSE-105: Structured Programming Language

COURSE INFORMATION			
Course Code Course Title	: CSE-105 : Structured Programming Language	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 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. It also deals with basic data structures like stack and queue.

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 computers.	C1-C3	1		1	T
CO2	Analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.	C4	3		2	T, F, MT
CO3	Develop basic programming skills with respect to program design and development.	C6	1,3		5	F
CO4	Develop the communication skill by presenting topics on Structured programming Language.	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

Introduction to computer programming: Programming Concepts, Program Development Stages, Structured Programming Language; **Number System:** binary, octal, decimal and hexadecimal systems; **Basic programming Structures:** Data types and their memory allocation, 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; **Bitwise operations:** AND, OR, NOT, XOR, Left shift, Right Shift; **File I/O:** Read write append from files; **Header file and Preprocessors:** Header files, Preprocessor; **Error Handling:** Exception handling; **Basic Data Structures:** Stack, Queue and Review

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12

CO1	Describe algorithm and solve problems using computers.	H											
CO2	Analyze 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									
CO4	Develop the communication skill by presenting topics on Structured programming Language.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO1	High	In order to solve complex engineering problems, knowledge of algorithms and computer usage is very important.
CO2 – PO2	High	To analyse the complex engineering problems one need to analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.
CO3 – PO3	High	To design and develop solutions for complex engineering problems, one need to develop basic programming skills.
CO4-PO10	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-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	Programming Concepts, Program Development Stages, Structured Programming Language	Class Test – 1
2	Lec 4 Lec 5 Lec 6	Number System: binary, octal, decimal and hexadecimal systems; Data types and their memory allocation	
3	Lec 7 Lec 8 Lec 9	Operators, expressions, Basic Input/output; Control Structure: “if else”, “switch”, Flow Charts	
4	Lec 10 Lec 11	Control Structures: Loop	Class Test – 2

	Lec 12		
5	Lec 13 Lec 14 Lec 15	Control Structures: Nested Loop	
6	Lec 16 Lec 17 Lec 18	One-dimensional array, Multi-dimensional array	
7	Lec 19 Lec 20 Lec 21	Character array/ String	
8	Lec 22 Lec 23 Lec 24	Function definition, function declaration, function call	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Different types of pointers, pass pointer as arguments, call by value vs call by reference	
10	Lec 31 Lec 32 Lec 33	Dynamic Memory Allocation: Malloc, calloc, realloc, free	
11	Lec 28 Lec 29 Lec 30	Recursion	Class Test – 3
12	Lec 34 Lec 35 Lec 36	Structures, unions, enumerations. File I/O; Header files, Preprocessor	
13	Lec 37 Lec 38 Lec 39	Error Handling; Bitwise Operations	
14	Lec 40 Lec 41 Lec 42	Stack, Queue and Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C4
	Class Participation	5%	CO4	A2
	Mid term	15%	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 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

CSE-106: Structured Programming Language Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE-106 : Structured Programming Language 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

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	Discuss algorithms and solve problems using computers.	C1-C3	1	3	5	F, T, ASG
CO2	Analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language practically.	C4	3		7	F, T, ASG, Q
CO3	Apply practical knowledge to develop basic programming skills with respect to program design and development.	C3, C6	1,3	3	7	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Discuss algorithms and solve problems using computers.									H			
CO2	Analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.						H						

CO3	Apply practical knowledge to 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 – PO9	High	In order to function effectively as a member or leader of a team, one needs to discuss algorithms with team members in order to solve problems using computers.
CO2 – PO6	High	In order to apply reasoning and take responsibilities relevant to the professional engineering practice, one needs to analyse the fundamental principles, typical characteristics and mechanisms of a structured programming language.
CO3 – PO6	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

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	 - _ _
Formal Assessment Continuous Assessment Final Examination	 4 3
Total	49

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	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
14	Lab 14	Error Handling

ASSESSMENT STRATEGY				
Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	C1-C3
			CO2	C4
	Class Participation	5%	CO1	C1-C3
	Assignment	15%	CO3	C3, C6
Online Test – 1		20%	CO1	C1-C3
			CO2	C4
Online Test – 2		20%	CO1	C1-C3
			CO2	C4
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 Schidlt
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, BJT, MOSFET, JFET, 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	**Solve** various mathematical problems to meet specific design criteria.	C3			2,5	F, ASC
CO4	**Apply** the knowledge of semiconductor diodes, BJT, MOSFET, JFET, 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Explain the basic operation of diodes, BJT, MOSFET, JFET, 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	Solve various mathematical problems to meet specific design criteria.			H									
CO4	Apply the knowledge of semiconductor diodes, BJT, MOSFET, JFET, 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-PO1	High	Basic of fundamental engineering relates to the basic operations of various electronic components.
CO2-PO2	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-PO3	High	To solve various mathematical problems to meet specific criteria will help designing and developing solutions.
CO4-PO3	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	
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	Class Test 2
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	15%	CO1	C2
			CO2	C3
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

REFERENCE SITE

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	Be able to analyze the characteristics of various types of active and passive electronic components by constructing simple circuits using these elements.	P2			3	R,Q,T
CO2	Be able to construct basic electronic devices to perform different mathematical operations and construct oscillator circuits.	P4			2, 3, 5, 6	R,Q,T
CO3	Be able to construct an electronic device for application in real life adapting the desired requirements.	P5	1		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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to analyze the characteristics of various types of active and passive electronic components by constructing simple circuits using this element.					H							

CO2	Be able to construct basic electronic devices to perform different mathematical operations and construct oscillator circuits.					H							
CO3	Be able to construct an electronic device for application in real life adapting the desired requirements using both hardware and simulation tools.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO5	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-PO5	High	Modern simulation tools will be used for verifying the operation of oscillator and mathematical operations performing circuits.
CO3-PO9	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 Experiment	 7 14
Self-Directed Learning Preparations of Lab Report Preparation of Lab-Test Preparation of Quiz Preparation of Presentation Engagement in Group Projects	 15 2 2 5 12
Formal Assessment Continuous Assessment Final Quiz	 10 1
Total	68

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	**Topics**
Week 1	Study of Diode Characteristics using Hardware implementation and simulation in PSpice Schematics
Week 2	Implementation of Diode Rectifier Circuits and study their rectification characteristics using Hardware implementation and simulation in PSpice Schematics.
Week 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.
Week 4	Study of Characteristics of Junction Field Effect Transistor (JFET) using Hardware implementation and simulation in PSpice Schematic.
Week 5	Mathematical operations using OP-AMP (Adder and Subtractor) using hardware implementation and simulation in PSpice Schematic.
Week 6	Mathematical operations using OP-AMP (Integrator and Differentiator) using hardware implementation and simulation in PSpice Schematic.
Week 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

ENG-102: Communicative English - 1

COURSE INFORMATION

Course Code Course Title	: ENG-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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	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-PO1	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-PO10	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-PO10	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 (6th). McGraw-Hill Publication
2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
3. Jones, L. (1981). Functions of English. (Student’s Book, 2nd) 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	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 the students the basic Concepts, Principles and operations of Vector, Matrices and Application of Geometry. The aim of this course is to develop the analytical capability of Vector, Matrices and Geometry. Finally this course is designed to develop the capability of students to solve practical problems.

OBJECTIVE

1. To impart basic knowledge on the Vector Analysis, Matrix and Geometry.
2. To familiarize the students with the working principle of calculating differentiation and integration of vector valued functions in Cartesian, cylindrical and spherical geometry.
3. To provide knowledge on using the concept of vector, matrix and Geometry in engineering area and solve other applied problems.
4. To be expert in imparting depth knowledge on the vector analysis, matrix and co-ordinate geometry.

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 and identify the physical explanation of different vector notation, explain the basic concept of matrix, 2D and 3D geometry.	C1-C2	1		1, 3	T, F
CO2	Interpret mathematics, science and engineering such as calculating volume and area of any object in a vector field.	C2	1		3	T, Mid Term Exam, F
CO3	Be proficient to analyse and demonstrate the technique in engineering problems which is taught in vector, matrix and Geometry.	C1, C3	1,3		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, MT- Mid Term Exam)

COURSE CONTENT

Vector Analysis: Definition of Vector, Scalars and Vectors, Equality of direction ratios and vectors, Addition and Subtraction and Multiplication of vectors by scalars, Position Vector of a point, Scalar and vector products of two vectors and their geometrical interpretation, 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, Definition of line, surface and volume integral, Integration of Vectors, Green's, stroke's and Gauss 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 linear equation or System of Linear Equation, linear dependence and independence of vectors, quadratic forms, matrix polynomials, determination characteristic roots and vectors, null space and nullity of matrix, characteristic subspace of matrix, 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, The plane-angle between two planes, 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), equation of conics, homogeneous equations 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, 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) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to define and identify the physical explanation of different vector notation, explain the complete concept about matrix, 2D and 3D geometry.	H											
CO2	Be able to interpret mathematics, science and engineering such as calculating volume and area of any object in a vector field.	H											
CO3	Be proficient to analyse and demonstrate the technique in engineering problems which is taught in vector, matrix and Geometry.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	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-PO1	High	In order to interpret mathematics, science and engineering such as calculating inverse matrix and volume and area of any object in vector field.
CO3-PO1	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.

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	Definition of vector, Scalars and Vectors, Equality of direction ratios and vectors, operations 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	
3	Lec 7 Lec 8 Lec 9	Integration of vectors (line, surface and volume integrals)	
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, Multiplication, Transpose and adjoint of a matrix, inverse of a matrix, Rank and elementary transformation.	
6	Lec 16 Lec 17 Lec 18	System of Linear Equation, Linear dependence and independence of vectors, Quadratic forms, matrix polynomials, determination characteristic roots and vector	
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	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	Test 1-3	20%	CO1, CO2	C1, C2, C3
			CO2	C3, A6

(40%)	Class Participation	5%	CO3	C2, C3
	Mid term	15%	CO2, 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)

REFERENCE BOOKS

1. Vector Analysis(2^{nd}) - Seymour Lipschutz, Dennis Spellman and Murray R. Spiegel, Schaum's outlines.
2. Vector Analysis - M. D. Raisinghania.
3. Elementary Linear algebra (12^{th}) - Wiely, Howard Anton and Chris Rorres.
4. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee.
5. Analytic Geometry -Abdur Rahman.
6. Analytical Solid Geometry- Shanti Narayan.

REFERENCE SITE

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		1,2	ASG, Q, R
CO2	Explain introductory theoretical and practical	C4	1		1	ASG, Q, R

	knowledge of power plant and their main components.					
CO3	Demonstrate fundamental ideas about heat transferring devices	P2	1	1	2	ASG, Q, R
CO4	Demonstrate basic knowledge about power transferring elements and components of robot.	P3	2	1, 2	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO2	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-PO1	High	Students will have theoretical knowledge as well as established engineering practices on power plant components and their operation.
CO3-PO3	Low	Students will have and use knowledge on cooling tower that guide the design of

		cooling tower in real field.
CO4-PO2	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 Practical / Tutorial / Studio Student-Centred Learning	 56 25 -
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

Class	Topics
1-8	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.
9-14	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.
15-18	Heat Transfer and equipment— Modes of heat transfer, Heat transfer using finned surface, Thermo-electric cooling, Heat pipe, Cooling of microchip and processor.
19-24	Pump, Compressor, Valve – Centrifugal pump, Positive displacement pump, Hydraulic and pneumatic actuator, Control valve (Pressure, flow and direction control valve)
25-34	Kinematics of Rigid body – Truss, Frame, Kinematic linkage,
35-44	Power transferring device – Belt-pulley, Various types of gear and gear train, Fluid Coupling, CVT
45-56	Robotics – Introduction to Robotics, Plane, rotational and spatial motion with applications to manipulators, Geometric configurations, arms and grippers, Control system of robots.

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Assignment	40%	CO1-CO4	C2, C4, P2, P3
Final Exam	Report	60%	CO1-CO4	C2, C4, P2, P3
	Quiz			
Total Marks		100%		

(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 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	Express the fundamentals of static and dynamic data structures and relevant standard algorithms.	C1-C3	1		1	T
CO2	Demonstrate advantages and disadvantages of specific algorithms and data structures.	C4	1		1	Mid Term Exam
CO3	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.	C1-C5	1,2		1	F
CO4	Determine and demonstrate bugs in the program, recognize needed basic operations with algorithms and data structures.	C1-C5	1		1	F
CO5	Develop the communication skill by presenting topics on data Structures and algorithms	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)

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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										
CO5	Develop the communication skill by presenting topics on Data Structures & Algorithms										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	High	Increase breadth and depth of knowledge by expressing the fundamentals of static and dynamic data structures and relevant standard algorithm
CO2-PO1	High	Increase breadth and depth of knowledge by demonstrating advantages and disadvantages of specific algorithms and data structures
CO3-PO2	Medium	Analyse and formulate different methods of analysis to select basic data structures and algorithms for autonomous realization of simple programs or program parts
CO4-PO2	High	Analyse and formulate different methods of analysis to determine and demonstrate bugs in the program, recognize needed basic operations with algorithms and data structures
CO5-PO10	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	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 Sorting:: Bubble sort, Insertion sort, Count sort	
3	Lec 7 Lec 8	Single Linked List	

	Lec 9		
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 31 Lec 32 Lec 33	Binary Search Tree	
11	Lec 28 Lec 29 Lec 30	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%)	Class Test	20%	CO1	C1-C3
	Class Participation	5%	CO5	A2
	Mid term	15%	CO 2	C4
Final Exam		60%	CO3	C1-C5
			CO4	C1-C5
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
2. Data Structures and Algorithm Analysis in C++ 2014

REFERENCE SITE
https://www.cs.usfca.edu/~galles/visualization/Algorithms.html https://www.shafaetsplanet.com/ https://forthright48.com/

CSE-204: Data Structures & Algorithms I Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE-204 : Data Structures & Algorithms I Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 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	Identify advantages and disadvantages of specific algorithms and data structures.	P1		1	1	E
CO2	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.	P3		1	1	O
CO3	Initiate practical knowledge to determine and demonstrate bugs in programs.	P5		1	1	Q
CO4	Formulate new solutions for problems or improve existing code using learned algorithms and data structures.	P6		1	1	O

(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
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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Demonstrate advantages and disadvantages of specific algorithms and data structures.	H											

CO2	Select basic data structures and algorithms for autonomous realization of simple programs or program parts.	H											
CO3	Initiate practical knowledge to determine and demonstrate bugs in programs.		M										
CO4	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	Justification
CO1-PO1	High	Increase breadth and depth of knowledge by demonstrating advantages and disadvantages of specific algorithms and data structures
CO2-PO1	High	Increase breadth and depth of knowledge by selecting basic data structures and algorithms for autonomous realization of simple programs or program parts.
CO3-PO2	Medium	Analyse and formulate different methods of analysis to determine and demonstrate bugs in programs
CO4-PO2	High	Analyse 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 Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	
Formal Assessment Continuous Assessment Final Examination	 4 3
Total	49

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics
1	Lab 1 Lab 2 Lab 3	Operations on static array list
2	Lab 4 Lab 5 Lab 6	Operations on dynamic array list
3	Lab 7 Lab 8 Lab 9	Binary search
4	Lab 10 Lab 11 Lab 12	Single linked list

5	Lab 13 Lab 14 Lab 15	Double linked list
6	Lab 16 Lab 17 Lab 18	Stack implementation by array and linked list
7	Lab 19 Lab 20 Lab 21	Queue Circular Queue
8	Lab 22 Lab 23 Lab 24	Graph Representation
9	Lab 25 Lab 26 Lab 27	Breadth first search
10	Lab 31 Lab 32 Lab 33	Depth first search
11	Lab 28 Lab 29 Lab 30	Tree Construction Preorder, Inorder, Postorder traversal
12	Lab 34 Lab 35 Lab 36	Binary search tree
13	Lab 37 Lab 38 Lab 39	Segment Tree
14	Lab 40 Lab 41 Lab 42	KMP Algorithm

ASSESSMENT STRATEGY

Components	Grading	CO	Bloom's Taxonomy
Continuous Evaluation	30%	CO 1	P1
Final Online Exam 1 & 2	50%	CO 2	P3
		CO 4	P6
Quiz	20%	CO3	P5
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
2. Data Structures and Algorithm Analysis in C++ 2014

REFERENCE SITE

https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
https://www.shafaetsplanet.com/
https://forthright48.com/

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 and utilize the fundamental features of an object-oriented programming language	C1- C3	1		1	T
CO2	Understand the benefits of object-oriented design and analyse when it is an appropriate methodology to use.	C2, C4	1,3		1	Mid Term Exam
CO3	Deduce object-oriented solutions for small problems, involving multiple objects.	C3, C5, C6	1,3		5	T, F
CO4	Illustrate good programming style and identify the impact of style on developing and maintaining programs.	C3-C4,C6	3		8	F
CO5	Develop the communication skill by presenting topics on Object Oriented Programming.	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

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 jav**a, 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Grasp and utilize the fundamental features of an object oriented language	H											
CO2	Understand the benefits of object oriented design and analyse when it is an appropriate methodology to use.		H										
CO3	Deduce object oriented solutions for small problems, involving multiple objects.			H									
CO4	Illustrate good programming style and identify the impact of style on developing and maintaining programs.				H								
CO5	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 – PO1	High	In order to solve complex engineering problems, knowledge of fundamental features of object-oriented programming language is very important.
CO2 – PO2	High	To analyse the complex engineering problems, one need to understand the benefit and analyse when object-oriented programming is an appropriate methodology to use.
CO3 – PO3	High	To design and develop solutions for complex engineering problems, one need to be able to deduce object-oriented solutions for small problems, involving multiple objects.
CO4 – PO4	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
CO5 – PO10	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 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	Overview of Object Oriented Programming (OOP) and introduction to C++; Features of OOP, namespaces	Class Test 1
2	Lec 4 Lec 5 Lec 6	Introduction to class and objects, Access Specifiers	
3	Lec 7 Lec 8 Lec 9	Member Functions, In-line functions, Friend functions, Function Overloading	
4	Lec 10 Lec 11 Lec 12	Introduction to the concept of Constructors and Destructors	Class Test 2
5	Lec 13 Lec 14 Lec 15	Copy 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	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-3
			CO3	C3, C5, C6
	Class Participation	5%	CO5	A2
	Mid term	15%	CO2	C2, C4
Final Exam		60%	CO3	C3, C5, C6

		CO4	C3-C4,C6
Total Marks	100%		

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

REFERENCE BOOKS

1. Teach Yourself C++ - Herbert Schidlt
2. Introduction to Algorithms (CLRS) 3rd Edition Sep 2009
3. Data Structures and Algorithm Analysis in C++ 2014

REFERENCE SITE

CSE-206: Object Oriented Programming Language Sessional

COURSE INFORMATION

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

PRE-REQUISITE

Course Code: 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 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	Design object-oriented solutions for small systems/ problems, involving multiple objects.	C6	1	3	5	E, O
CO2	Demonstrate good programming style and discuss the impact of style on developing and maintaining programs.	C3	1		1	O
CO3	Identify the relative merits of different algorithmic designs, programming constructs and data structures.	P5	3		7	Q, V
CO4	Write code, test, document and prepare a professional looking package for specified systems / problems.	C3, C6	1,3	3	5	E, ASG

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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Design object-oriented solutions for small systems/ problems, involving multiple objects.									H			
CO2	Demonstrate good programming style and discuss the impact of style on developing and maintaining programs.												H
CO3	Identify the relative merits of different algorithmic designs, programming constructs and data structures.						H						
CO4	Write code, test, document and prepare a professional looking package for specified systems / problems.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1– PO9	High	In order to function effectively as an individual or leader of a team, one need to learn to design object-oriented solutions for small systems/ problems, involving multiple objects.
CO2 – PO12	High	To recognize the need for and have the ability to engage in life long learning, one must be able to demonstrate good programming style and discuss the impact of style on developing and maintaining programs.
CO3 – PO6	High	In order to apply reasoning and take responsibilities relevant to the professional engineering practice, one need to identify the relative merits of different algorithmic designs, programming constructs and data structures.
CO4 – PO9	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	-
Practical / Tutorial / Studio	42
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	Topics
1	Introductory session on OOP
2	Structure and Classes with namespace
3	Class and objects with access specifier
4	Member Functions, In-line functions, Friend functions
5	Function Overloading
6	Introduction to the concept of Constructors and Destructors
7	Copy Constructors
8	Inheritance: Introduction, derived and base classes, accessing base class members, access specified for ‘protected’
9	Multiple inheritance, Constructor and destructor in Inheritance
10	Virtual functions, runtime polymorphism
11	Overriding Abstract class
12	Operator overloading: Introduction, overloading of unary operators
13	Operator overloading: Overloading of binary operators,
14	Multiple overloading

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Evaluation	20%	CO1	C6
			CO4	C3, C6
	Class Participation	5%	CO4	C3, C6
	Assignment	10%	CO4	C3, C6
Online Test – 1		25%	CO1	C6
			CO2	C3
Online Test – 2		25%	CO1	C6
			CO2	C3
Quiz/ Viva		15%	CO3	P5
Total Marks		100%		

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

REFERENCE BOOKS

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

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 grammars. 3. To analyse 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		1, 3	T, F
CO2	Design finite automata and regular expressions for regular languages.	C4, C6	1,2,3		1,3,5	T, F
CO3	Design context free grammar and pushdown automata for context free languages.	C4, C6	1,2,3		1, 5	T, F
CO4	Illustrate Turing machines and investigate the limits of algorithmic solvability.	C2, C4	1		1,3,8	T, F
CO5	Develop the communication skill by presenting topics on theory of computation.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify the mathematical foundations of computation including mathematical proofs for computation.		M										
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	Illustrate Turing machines and investigate the limits of algorithmic solvability.				M								
CO5	Develop the communication skill by presenting topics on theory of computation.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO2	Medium	As the graduates will have to identify different mathematical proofs for different computation models.
CO2-PO3	High	As the graduates will have to design finite automaton and regular expression for different regular language meeting specific needs of the language.
CO3-PO3	High	As the graduates will have to design context free grammar and pushdown automaton for different context free language meeting specific needs of the language.
CO4-PO4	Medium	Graduates will have to research thoroughly to find out solvability of any algorithm for illustrating it using Turing Machines.
CO5-PO10	Low	As the graduates will have to present on some topic of theory of computation, it will help them to improve their 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	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 Lec 17 Lec 18	Regular expressions 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%	CO1	C3, C5
			CO2	C4, C6
			CO3	C4, C6
	Class Participation	5%	CO5	A2
	Mid term	15%	CO2	C4, C6
			CO3	C4, C6
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	Be proficient to **describe** the operating principles of generator, motor and transformer and be able to **demonstrate** the practical application.	C2	1	1	2, 3	T, F
CO2	Be capable to **understand** the basics of electrical measurement systems and **explain** their characteristics and different measurement methods.	C2, A2			2, 3	F, ASG, Pr
CO3	Be adept in **analyzing** measurement data and performance of measurement systems	C2			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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be proficient to **describe** the operating principles of generator, motor and transformer and be able to **demonstrate** the practical application.	M											
CO2	Be capable to **understand** the basics of electrical measurement systems and **explain** their characteristics and different measurement methods.	H											
CO3	Be adept in **analyzing** measurement data and performance of measurement systems	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	Medium	Breadth and depth of knowledge will be achieved partially through describing operating mechanism of energy conversion devices.
CO2-PO1	High	Breadth and depth of knowledge will be achieved through demonstrating generator, motor and transformer to solve the real-life engineering problems
CO3-PO1	Low	Breadth and depth of knowledge will be achieved through explaining and defining different methods of measurement.

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	**Topics**	**Assessment Methods**
Week 1	**DC Generator**	
Class 1	Overview of Electrical Energy conversion	
Class 2	Introduction to DC generator and its principle of operation	
Class 3	Commutation principle and slip rings	
Week 2	**DC Generator**	
Class 4	Construction of DC generator and different parts	
Class 5	Lap winding and wave winding and its comparison	
Class 6	Emf equation of DC generator and related mathematical problems	
Week 3	**DC Motor**	

Class 7	Construction and operating principle of DC motor	Class Test 1
Class 8	Flemings right hand rule and left-hand rule, conversion of energy	
Class 9	Differences between DC generator and DC motor	
Week 4	**DC Motor**	Class Test 2
Class 10	Back emf and related equations for DC motor	
Class 11	Speed control, Torque –speed characteristics of different types DC motors.	
Class 12	Related mathematical problems of DC motor	
Week 5	**Transformer**	
Class 13	Introduction to Transformer and its principle of operations	
Class 14	Types of transformer and ideal characteristics	
Class 15	Equivalent circuit of Transformer	
Week 6	**Transformer**	
Class 16	Vector diagrams of transformer under different conditions	
Class 17	Mathematical problems of Transformer	
Class 18	Losses in transformer and their explanations	
Week 7	**Synchronous Generator**	Mid Term Exam
Class 19	Synchronous Generator: Operating principle	
Class 20	Excitation systems of Synchronous Generator	
Class 21	equivalent circuit of synchronous Generator	
Week 8	**Instruments & Measurement overview**	
Class 22	Introduction on Measurement and instrumentation	
Class 23	Basic requirements, significance and methods of measurement.	
Class 24	Functional elements of a generalized measurement system and classification of instruments.	
Week 9	**Transducers**	
Class 25	Transducers: Introduction, advantage of using Electrical Transducers	
Class 26	. Resistance, Inductance and Capacitive transducer	
Class 27	Hall effect transducer and Optical transducer.	
Week 10	**Transducers**	
Class 28	Thermocouple, Resistance Temperature Detector and Thermistor.	
Class 29	Thermal Imaging- Applications, Measurement of Strain	
Class 30	Measurement of Force (piezoelectric sensors) and Torque.	
Week 11	**Noise Performance Analysis**	
Class 31	Noise in a measurement system: Typical source of noise in a measurement system.	
Class 32	Types of noise in measurement system- Electromagnetic Interference, Inductive and Capacitive coupling.	
Class 33	Techniques for compensation of noise: Shielding, Filtering and Ground isolation.	
Week 12	**Signal Conditioning**	
Class 34	Overview of signal conditioning: Noise elimination and compensation, Amplification, Linearization.	
Class 35	Different methods in use: A\D and D\A conversion for suitable output devices and data acquisition.	
Class 36	A\D converters: Basics, techniques- parallel/flash, single slope (ramp), successive approximation, sample and hold circuit	
Week13	**Instrumentation Amplifiers**	Class Test 3
Class 37	Different instrumentation amplifier, Operation amplifiers	
Class 38	Application of amplifiers, filters for signal conditioning	
Class 39	Data Acquisition system: Microprocessor and embedded system applications.	
Week 14	**Data Transmission, Telemetry and Data Presentation**	
Class 40	Current, Voltage and Frequency telemetry. Telemetry Applications	
Class 41	Various types of display devices and their interfacing and applications	
Class 42	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 Participation	5%	CO 2	C6
	Mid term	15%	CO3	C3
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

REFERENCE SITE

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 behaviour 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	P3		1	2	R, Q, LT

	transformer, alternator, dc motor etc. and justify these characteristics under various loading condition.					
CO2	**Identify** the characteristics of electrical machines like dc generator, dc motor etc. and trace various curves like armature voltage vs. armature current curve for dc generator or torque-speed curve of dc motor.	P4	1	1	1,3,6	R, Q, LT
CO3	**Apply** the basic idea of control system through the controlling of water level and water flow by feedback transducer.	P4	1	1	3,6	R, Q, LT
CO4	**Perform** project task and **design** electrical machine **adapting** to requirement.	P6	1	1,3,5	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	Identify the characteristics of electrical machines like dc generator, dc motor etc. and trace various curves like armature voltage vs. armature current curve for dc generator or torque-speed curve of dc motor.					M							
CO3	Apply the basic idea of control system through the controlling of water level and water flow by feedback transducer.									H			
CO4	Perform project task and design electrical machine adapting to requirement.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO9	High	Students will function effectively as an individual, and as a member or leader in diverse teams through participating in computing electrical machines performance.
CO2-PO5	Medium	Level of understanding of the appropriateness of the tools will be achieved through working with the devices.
CO3-PO9	High	While designing electrical machine, they will learn about individual role and team management.
CO4-PO10	Medium	Communication skills will improve, while presenting the designed project.

TEACHING LEARNING STRATEGY

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

Lecture Practical	7 14 -
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 3 3 2 3 10
Formal Assessment Continuous Assessment Final Examination	 7 1
Total	50

TEACHING METHODOLOGY

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

COURSE SCHEDULE

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

ENG-202: Communicative English - II

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

PRE-REQUISITE

Course Code: ENG -102
Course Title: Communicative English – I

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		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		2	1	Pr, R
CO4	Analyze any problem critically, analyze and interpret data and synthesize information to provide valid conclusions	C3		4, 5	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Obtain the basic knowledge of academic reading and technical vocabularies.
CO2-PO1	High	Gather deep knowledge of the techniques involving academic article writing.
CO-2-PO12	Low	Apply this skill in academic fields throughout the entire life.
CO3-PO9	Medium	Communicate in a team and adapt with the diversity of human nature.
CO3-PO10	High	Build string communication skills within shortest possible time.
CO4-PO2	Medium	Able to analyse the complexity of a critical situation and derive solution.
CO4-PO4	Medium	Able to investigate through the problem to achieve a better understanding of the problem.
CO4-PO10	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-Centred Learning	42
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	4
Final Examination	-
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 Equations, 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

Course Code: Nil
Course Title: Nil

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

This course is designed to teach the students the basic 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 the analytical and practical capability of 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

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** differential equations of various types and **recognize** the basic properties of Laplace and Fourier transform.	C1-C2	1		1, 3	T, F
CO2	**Interpret** the classifications of differential equations and **estimate** the technique of Laplace transform and Fourier transform of some elementary function.	C2	1		3	T, MT, F
CO3	**Solve** different types of differential equations and **apply** Laplace transform to Ordinary Differential Equation and Fourier as well as Inverse Fourier transform to make use of boundary value problems in Engineering fields	C3	1,3		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 Equations (DE): Introduction and Formulation of DE, Degree and order of Ordinary Differential Equation (ODE), first order but higher degree DE and also by various methods, general LEs of second and higher order, Euler's homogeneous linear DEs , Solution of DEs by methods based on factorization, Application of ODE, Frobenious methods, Differential equations of the higher order, Bessel's functions, Legendre's polynomial, Power series solution of DE and their application, Integral form of DE and its application to engineering problem, Formation of partial differential equations, linear and nonlinear first order Partial Differential Equation (PDE), Standard form Linear Equations (LE) of higher order, 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, Linear PDE with constant coefficients, 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, Partial fraction, 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, Diffusion, wave, Laplace Equation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Identify** differential equations of various types and **recognize** the basic properties of Laplace and Fourier transform.	H											
CO2	**Interpret** the classifications of differential equations and **estimate** the technique of Laplace transform and Fourier transform of some elementary function.	H											
CO3	**Solve** different types of differential equations and **apply** Laplace transform to DE and Fourier and inverse Fourier transform to make use of boundary value problems in Engineering fields.	H											

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Be able to recognize differential equations of various types and compare the basic properties of Laplace and Fourier transform. For gaining the knowledge of mathematics, science and engineering field.
CO2-PO1	High	In order to expound the classifications of differential equations and estimate the technique of Laplace transform and Fourier transform of some elementary function, the knowledge of mathematics, science and engineering is needed.
CO3-PO1	High	In order to analyse basic estimation of solving DE and boundary value problems, complex engineering problems using Laplace and Fourier transform the knowledge of these fields are required.

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 DE, Formulation of DE, Degree and order of ODE, Solution of first order DE by various methods	Class Test 1
2	Lec 4 Lec 5 Lec 6	Solution of first order DE by various methods, 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 and problems	
4	Lec 10 Lec 11 Lec 12	Solution of differential equations of the higher order, Bessel's functions, Legendre's polynomial, Power series solution of DE and their application, Integral form of DE and its application to engineering problem	Class Test 2
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	
7	Lec 19 Lec 20 Lec 21	Equation of second order with variable coefficients, Second order PDE and classification to canonical solution, wave equation, Application of ODE and PDE	
8	Lec 22 Lec 23 Lec 24	Definition, properties and sufficient conditions for existence of Laplace transforms, Laplace transform of some basic functions, LT of derivatives	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Unit step function, periodic function, some special theorems on LT, inverse Laplace transform	
10	Lec 31 Lec 32 Lec 33	Partial function, Heaviside expansion formula, Convolution theorem	
11	Lec 28 Lec 29 Lec 30	Evaluation of improper integral, solution of DE by LT, Application of LT	Class Test 3
12	Lec 34 Lec 35 Lec 36	Real and complex form Fourier series, definition and expansion of function of x in a Fourier series, physical application of Fourier series	
13	Lec 37 Lec 38 Lec 39	Finite Fourier series, Fourier integral, inverse Fourier series	
14	Lec 40 Lec 41 Lec 42	Fourier transform and their uses in solving boundary value problems, Diffusion, wave, Laplace equation	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1, CO2	C1, C2
			CO2	C2
	Class Participation	5%	CO3	C3
	Mid term	15%	CO2, CO3	C2, C3

Final Exam	60%	CO 1	C1, C2
		CO 2	C2
		CO 3	C3
Total Marks	100%		

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

REFERENCE BOOKS

1. Ordinary and Partial Differential Equations (18th)- M.D.RAISINGHANIA.
2. Differential Equations (3rd)- Shepley L. Ross.
3. Differential Equations by Glen R. Hall.
4. Theory and problems of Laplace Transform, Schaum's outlines series, Murray R. Spiegel.

REFERENCE SITE

CE-250: Engineering Drawing & Cad Sessional

COURSE INFORMATION			
Course Code Course Title	: CE-250 : Engineering Drawing & Cad 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 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

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 2D and 3D views of simple objects.	C2	2	1	4	Class Assessment, ASG, Q
CO2	Apply the knowledge to draw sectional view, plan view and elevation of various objects and structures by hand and AutoCAD.	C3	2	1	4	Class Assessment, 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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Breadth and depth of knowledge will be achieved through understanding views of different object in 2D and 3D space.
CO2-PO2	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 Practical / Tutorial / Studio Student-Centred Learning	 12 - -
Self-Directed Learning Assignment Preparation Revision Assessment Preparations	 24 - 03
Formal Assessment Quiz Viva Class Performance	 2 1 18
Total	60

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics
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	Plan/Elevation of Building
5	Lab-5	Section of Building
6	Lab-6	CSE Drawing
7	Lab-7	
8	Lab-8	AutoCad Tools
9	Lab-9	AutoCad Tools
10	Lab-10	AutoCad Tools + Isometric Views
11	Lab-11	AutoCad Orthographic + Sectional views
12	Lab-12	AutoCad Plan of Building
13	Lab-13	AutoCad Elevation + Section of Building
14	Lab-14	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Quiz	20	CO1	C1
			CO2	C2
	Class Participation	10	CO1	C1
	Assignment/ Report	30	CO2	C2

Final Exam	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-213: Computer Architecture

COURSE INFORMATION

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

PREREQUISITE

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. The course addresses the bridge between gate logic and executable software, and includes programming both in assembly language (representing software) and HDL (representing hardware).

OBJECTIVE

1. To develop the basic idea about computer architecture.
2. To learn the techniques of high performance 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	2	-	1	T, F
CO2	Understand the Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.	C2	4	-	3	T, M, F
CO3	Develop and design an instruction set architecture and subsystems of central processing unit.	C4, C6	1,3	3	6	F
CO4	Develop the communication skill by presenting topics on computer architecture.	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; V - Viva; F – Final Exam; MT – Mid Term)

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the Overview, Computer System, Arithmetic and logic, Central processing unit and parallel organization	H											
CO2	Understand the Computer and Processor Design, Hazards; Exceptions; external and internal memory Pipeline and multiple processor systems.		H										
CO3	Develop and design an instruction set architecture and subsystems of central processing unit.			H									
CO4	Develop the communication skill by presenting topics on computer architecture.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO1	High	Increase breadth & depth of knowledge through understanding the structure of computer architectures.
CO2-PO2	High	Understand and solve various complex problems by analysing processor design, hazards and exceptions.
CO3-PO3	High	Understand and implement the design issues of instruction set architecture and subsystems of central processing unit.
CO4-PO10	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 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	Fundamentals of Computer Organization and Architecture: Fundamentals of computer Design, Processor Design	Class Test 1
2	Lec 4 Lec 5 Lec 6	Computer Evolution and Performance, Processor Design	
3	Lec 7 Lec 8 Lec 9	Computer Function and Interconnection: overview of computer BUS standards, Multiprocessors: types of multiprocessors, performance, single bus multiprocessors, multiprocessors connected by network, clusters	
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 Infini Band	
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 31 Lec 32 Lec 33	Processor Structure and Function; Processor design: datapaths, single-cycle and multi-cycle implementations; Control Unit design - hardwired and microprogrammed; Hazards; Exceptions;	
11	Lec 28 Lec 29 Lec 30	Reduced Instruction Set Computers; RISC Processor, Pipeline: pipelined datapath and control, superscalar and dynamic pipelining;	Class Test 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, Nonuniform Memory Access, Vector Computation	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C2
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C2
Final Exam		60%	CO1	C2
			CO2	C2
			CO3	C4, C6
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 Course Title	: CSE-215 : Data Structures & Algorithms II	Lecture Contact Hours Credit Hours	: 3.00 : 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.	C1	1		1	T
CO2	Apply required modification and optimization in any data structure and algorithm in common engineering design.	C2-C6	1, 3		1-3	MT
CO3	Illustrate important algorithmic design paradigms and methods of analysis.	C2-C5	1, 3		1-3	T,F
CO4	Analyse the running time complexity and correctness of any algorithm.	C2-C4	1		2, 3	F
CO5	Develop the communication skill by presenting topics on operating systems.	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

Trees: Heap, Priority Queue, AVL Tree, TRIE; **Set-List:** Disjoint set, Skip List; **Greedy Strategy:** Prim's algorithm, Kruskal's algorithm, Dijkstra's algorithm; **Dynamic Programming:** Bellman Ford's algorithm, Matrix chain multiplication, 0-1 knapsack, Longest common subsequence finding; **String Matching:** KMP algorithm; **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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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										
CO5	Develop communication skills by presenting topics on data structures and algorithms.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	H	Increase breadth and depth of knowledge by being familiar with commonly used data structures and algorithms.
CO2-PO3	H	Understand and implement the required data structures and algorithms with required modifications based on the scenario.
CO3-PO2	H	Analyse and formulate different methods of analysis to illustrate important algorithmic design paradigms.
CO4-PO2	H	Analyse the time complexity and correctness of any algorithm by using different analytical approaches

CO5-PO10	L	Develop communication skills through participating in presentation etc.

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	Heap, Priority Queue	
2	Lec 4 Lec 5 Lec 6	TRIE, AVL Tree	
3	Lec 7 Lec 8 Lec 9	Disjoint Set, Skip List	**Class Test 1**
4	Lec 10 Lec 11 Lec 12	Prim's Algorithm, Kruskal's Algorithm	
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	**Class Test 2**
7	Lec 19 Lec 20 Lec 21	Longest Common Subsequence Finding	
8	Lec 22 Lec 23 Lec 24	Matrix Chain Multiplication	
9	Lec 25 Lec 26 Lec 27	Mergesort, Quicksort	**Mid Term**
10	Lec 31 Lec 32 Lec 33	Flow Network	
11	Lec 28 Lec 29 Lec 30	Directed Acyclic Graph, Topological Sort, Strongly Connected Components	
12	Lec 34 Lec 35 Lec 36	Map Coloring Problem, 0-1 Knapsack by Branch and Bound	**Class Test 3**

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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1
			CO3	C2-C5
	Class Participation	5%	CO5	A2
	Mid term	15%	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) – Mark Alan Weiss

REFERENCE SITE

CSE-216: Data Structures and Algorithms-II Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-216 : Data Structures and Algorithms-II Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 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 structures
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	P1	3	2	1	FT, ASG
CO2	Implement any algorithm from its pseudo code and writing pseudo code from its algorithm	C2	1	3	3	FT, ASG
CO3	Choose appropriate data structure and algorithm at the appropriate scenario	C3,C4	2	5	4	ASG
CO4	Apply changes and modifications in the existing data structures and algorithms to reduce the time and space complexity of any problem	C3-C6	1	3	5	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

Data Structure: Binary Search Tree, Heap-Priority Queue, TRIE; **Greedy Method:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm; **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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the implementation of any data structure or algorithm	H											
CO2	Implement any algorithm from its pseudo code and writing pseudo code from its algorithm		M										
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-PO1	High	Increase breadth and depth of knowledge by understanding the implementation of any data structure or algorithm
CO2-PO2	Medium	Improving the skill of analysing a problem by implementing any algorithm from its pseudo code.
CO3-PO5	High	Increase the level of understanding of the appropriateness of the tool by choosing appropriate data structure and algorithm at the appropriate scenario
CO4-PO3	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	-
Practical / Tutorial / Studio	42
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
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	Remarks
1	Lab 1	Binary Search Tree	
2	Lab 2	Heap, Priority Queue	
3	Lab 3	TRIE	
4	Lab 4	Prim's Algorithm	
5	Lab 5	Kruskal's Algorithm	
6	Lab 6	Dijkstra's Algorithm	
7	Lab 7	Matrix Chain Multiplication	
8	Lab 8	Longest Common Subsequence	
9	Lab 9	0-1 Knapsack	
10	Lab 10	Quick Sort	
11	Lab 11	Merge Sort	
12	Lab 12	Ford Fulkerson's Algorithm	
13	Lab 13	Topological Sort, Finding Strongly Connected Components	
14	Lab 14	Branch and Bound: 0-1 Knapsack	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	P1
			CO2	C2
	Class Participation	5%	CO1	P1
	Assignment	15%	CO3	C3,C4
Online Test – 1		20%	CO1	P1
			CO2	C2
Online Test – 2		20%	CO1	P1
			CO2	C2
Viva/ Quiz		20%	CO4	C3-C6
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
https://www.cs.usfca.edu/~galles/visualization/Algorithms.html https://www.shafaetsplanet.com/ https://forthright48.com/

CSE-219: Mathematical Analysis for Computer Science

COURSE INFORMATION			
Course Code Course Title	: CSE-219 : Mathematical Analysis for Computer Science	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 aimed to gain introductory knowledge on probability, computation of probability with its practical and theoretical application in studying computer science.			
OBJECTIVE			
1. To learn mathematical models and methods to analyze problems that arise in computer science. 2. To understanding basics of probability theorem, the concept of random variable, standard distributions in discrete and continuous cases. 3. 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	C3, C4	2	2	2	T, F
CO2	Understand the basics of probability theorem, concept of random variable	C2	1		1, 3	Q,MT,F
CO3	Apply standard distributions in discrete and continuous cases	C3, P6	4	3	5	ASG
CO4	Apply stochastic process and Queuing theory	C3, A2			2,8	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Analysis of computational problem using mathematical models and methods		H										

CO2	Understand the basics of probability theorem, concept of random variable	H	M										
CO3	Apply standard distributions in discrete and continuous cases			H									
CO4	Apply stochastic process and Queuing theory			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO2	High	Able to increase problem analysis by analysis of computational problem
CO2-PO1	High	Understanding the basics theorem will highly increase the breadth and depth of knowledge
CO2-PO2	Medium	Concept of the theorem will increase the analytic capability
CO3-PO3	High	Application of standard distribution will help to understand the breadth and uniqueness of engineering problem
CO4-PO3	Medium	Application of stochastic process and Queuing theory enable to develop solutions for different problem

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
Assignment 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	Recurrence Problems: The Tower of Hanoi Lines in The Plane The Josephus Problem	Class Test 1
2	Lec 4 Lec 5 Lec 6	Sums: Manipulation of sums, Multiple Sums, General Methods, Finite and Infinite Calculus, Infinite Sums	
3	Lec 7 Lec 8 Lec 9	Number Theory: Divisibility, Primes, Prime Examples, Factorial Factors	
4	Lec 10 Lec 11 Lec 12	Number Theory: Relative Primarily, mod: The Congruence Relation, Independent Residues, Additional Applications, Phi and Mu	Class Test 2
5	Lec 13 Lec 14 Lec 15	Special Numbers: Stirling Numbers, Eulerian Numbers, Harmonic Numbers	
6	Lec 16 Lec 17	Special Numbers: Harmonic Summation, Bernoulli Numbers, Fibonacci Numbers	

	Lec 18		
7	Lec 19 Lec 20 Lec 21	Generating Functions	
8	Lec 22 Lec 23 Lec 24	Introduction to Probability: Definition, Conditional Probability, Independent Probability, Bayes' Formula	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Discrete Random variables: The Bernoulli Random Variable, The Binomial Random Variable, The Geometric Random Variable, The Poisson Random Variable	
10	Lec 31 Lec 32 Lec 33	Continuous Random variables: The Uniform Random Variable, Exponential Random Variables, Gamma Random Variables, Normal Random Variables,	
11	Lec 28 Lec 29 Lec 30	Expectation of a Random Variable: The Discrete Case, The Continuous Case, Variance	Class Test 3
12	Lec 34 Lec 35 Lec 36	Stochastic Process: Definition with application Markov chains: Definition, Transforming a Process into a Markov Chain, Chapman–Kolmogorov Equations	
13	Lec 37 Lec 38 Lec 39	Hidden Markov Model: Modelling	
14	Lec 40 Lec 41 Lec 42	Queuing models: open and closed queuing network; Application of queuing models	

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	15%	CO 2	C2
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. 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

CSE-220: Object Oriented Programming language Sessional-II

COURSE INFORMATION			
Course Code Course Title	: CSE-220 : Object Oriented Programming language Sessional-II	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 0.75

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	5	4	E
CO2	Identify and express how to use advance programming features such as GUI design, exception handling and multi-threading.	P3, P4	1	5	6	O
CO3	Demonstrate how to design and develop a complete real-world software solution.	C3, P5	1	5	5	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO1	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 – PO5	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 – PO3	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	21
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	-
Formal Assessment	
Continuous Assessment	4
Final Examination	3
Total	28

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab 1,2	Basic Concept on java, basic operation and command line	3:00 hrs in alternate week
2	Lab 3,4	Introduction to class, inheritance, access specifiers	
3	Lab 5,6	Class abstraction, Interface, Closure	
4	Lab 7,8	Java Array and String, Exception Handling	
5	Lab 9,10	Java I/O (serialization) and stream, Collection Frameworks	
6	Lab 11,12	Generic Class and Methods, Concurrency	
7	Lab 13,14	Introduction with swings, Swing Layouts	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Class Evaluation	30%	CO1	P1, P2
Online I	25%	CO2	P3, P4
Online II	25%	CO2	P3, P4
Quiz	20%	CO3	C3, P5
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

EECE-279: Digital Electronics and Pulse Technique

COURSE INFORMATION			
Course Code Course Title	: EECE-279 : Digital Electronics and Pulse Technique	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 and familiarize the basic logic gates as well as to be able to design various combinational and sequential circuits using logic gates.

OBJECTIVE

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronic circuits.
2. To prepare students to perform the analysis and design of various combinational and sequential circuits using gates.

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 number systems and **interpret** its application in digital design.	C2			1,3	T, ASG, F
CO2	**Design** various combinational and sequential circuits.	C6	2		1,5	T, MT, ASG, F
CO3	**Analyze** the memory elements, state table and state diagrams of the sequential circuit.	C4			1,5	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 number systems and codes: Number base conversion, Complements and related problems, Binary codes; **Analysis and synthesis of digital logic circuits:** Basic logic functions, Boolean algebra, combinational logic design, minimization of combinational logic; **Implementation of basic static logic gates in CMOS and BiCMOS:** DC characteristics, noise margin and power dissipation. Power optimization of basic gates and combinational logic circuits; **Modular combinational circuit design:** Pass transistor, pass gates, multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, binary arithmetic elements and ALU design; **Programmable logic devices:** Logic arrays, field programmable logic arrays and programmable read only memory; **Sequential circuits:** Different types of latches, flip-flops and their design using ASM approach, timing analysis and power optimization of sequential circuits; **Modular sequential logic circuit design:** shift registers, counters and their applications;

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify the structure of various number systems and interpret its application in digital design.	H											
CO2	Design various combinational and sequential circuits.		M										
CO3	Analyze the memory elements, state table and state diagrams of the sequential circuit.			M									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Basic knowledge of number system is required to differentiate among various number systems and comprehend their application in regards of designing digital circuits.
CO2-PO2	Medium	Competence to generate solutions for dynamic and efficient design of combinational and sequential circuits is necessary.
CO3-PO3	Medium	Ability to design sequential circuits with maximum efficiency and environmental friendly elements 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	Number base conversion Complements and related problems Binary codes	Class Test-1
2	Lec-4 Lec-5 Lec-6	Basic theories and properties of Boolean Algebra Canonical and standard forms Mathematical problems on Boolean Algebra	
3	Lec-7 Lec-8 Lec-9	Simplification of Boolean functions through Map method Product of Sums simplification NAND and NOR implementation	
4	Lec-10 Lec-11 Lec-12	Simplification with Don't Care conditions The Tabulation method of simplification Related mathematical problem solving	Class Test-2
5	Lec-13 Lec-14 Lec-15	Introduction to Combinational Logic Discussion on Design procedure Adders and subtractors	
6	Lec-16 Lec-17 Lec-18	Code conversion Boolean function implementations Exclusive-OR AND equivalence functions	
7	Lec-19 Lec-20 Lec-21	Parity generation and checking Combinational logic with MSI and LSI Coder/decoder and multiplexer/demultiplexer design.	Mid Term Exam
8	Lec-22 Lec-23 Lec-24	Modular combinational circuit design: Pass transistor, pass gates Multiplexer, demultiplexer and their implementation in CMOS Decoder, encoder, comparators, binary arithmetic elements and ALU design	

9	Lec-25 Lec-26 Lec-27	Programmable logic devices: Logic arrays Field programmable logic arrays Programmable read only memory	
10	Lec-28 Lec-29 Lec-30	Sequential circuits: Different types of latches Flip-flops: master-slave, D, JK, T Design of flip-flops using ASM approach	Class Test-3
11	Lec-31 Lec-32 Lec-33	Timing analysis Power optimization of sequential circuits Modular sequential logic circuit design: shift registers	
12	Lec-34 Lec-35 Lec-36	Parallel I/O shift registers Series I/O shift registers Universal shift register	
13	Lec-37 Lec-38 Lec-39	Counters: Introduction Asynchronous counters: up and down Synchronous counters: up and down	
14	Lec-40 Lec-41 Lec-42	BCD counters and other modulo counters Ring counter, Johnson counter Applications of registers and counters	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1,C2
			CO2	C6
	Assignment	5%	CO1	C1,C2
			CO2	C6
	Mid term	15%	CO2	C6
			CO3	C4
Final Exam		60%	CO1	C1,C2
			CO2	C6
			CO3	C4
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 Mano; Prentice Hall of India Private Ltd.
2. Digital Fundamentals –Thomas L Floyd; Prentice Hall International, Inc.
3. Pulse, Digital and Switching waveforms - Jacob Millman & Herbert Taub, Tata McGraw- Hill.

REFERENCE SITE

EECE-280: Digital Electronics and Pulse Technique Sessional

COURSE INFORMATION			
Course Code Course Title	: EECE-280 : Digital Electronics and Pulse Technique Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 0.75

PRE-REQUISITE
Course Code: EECE 279 Course Title: Digital Electronics and Pulse Technique
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
Being one of the fundamental requirements for electrical engineering students of Level-3, the course emphasizes on a good understanding of basic concepts about digital logic circuits. Besides, it helps to form a firm grasp of the modern design approach that relies on computer-aided design (CAD) tools. It exploits areas like Boolean algebra, combinational circuits, sequential circuits and memory elements. The students are first taught about the number system and logic gates before introduction to digital IC technology. This paves the way of exposure to CAD tools like Schematic Capture and Verilog constructs which are useful for the design of logic circuits. It will be followed by implementation of Verilog code in FPGA board. The aim of the course is to familiarize students with modern design methodology to illustrate how digital design is carried out in practice today.
OBJECTIVE
1. To acquaint the students with the fundamental concepts in classical manual digital design. 2. To familiarize the students clearly with the way in which digital circuits are designed today using CAD tools like Schematic Capture and Verilog HDL. 3. To develop students' analytical skills to build complex digital circuit and impart the knowledge about 'Green Technology' to integrate it in their projects. 4. To enhance skill set of students in designing various memory devices such as flip flops, registers and counters followed by implementation in FPGA boards. 5. To develop communication and project management skills in the students through presentation and project.

COURSE 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	**Follow** instructions on building of combinational and sequential circuits using basic logic gates and computer simulation using CAD tools.	P3			3	R,Q,T
CO2	**Apply** basic Boolean laws and K-map to reproduce a simplified and efficient version of large scale complex circuits meeting the specified requirements using minimum hardware.	P3	1,3		2,3,5,6	R,Q,T
CO3	Proficient to deconstruct a device and **demonstrate** skills to troubleshoot a digital circuit.	A3			6	R,Q,T
CO4	**Construct** different types of digital electronic circuits with or without memory elements for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.	P7	1,4		2,3,5,6,7	PR, 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

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

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Follow** instructions on building of combinational and sequential circuits using basic logic gates and computer simulation using CAD tools.									H			
CO2	**Apply** basic Boolean laws and K-map to reproduce a simplified and efficient version of large scale complex circuits meeting the specified requirements using minimum hardware.										L		
CO3	Proficient to deconstruct a device and **demonstrate** skills to troubleshoot a digital circuit.					H							
CO4	**Construct** different types of digital electronic circuits with or without memory elements for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO9	High	Construction of digital circuits on hardware level require teamwork and on simulating tools require individual work. Ability to work as an individual or as a team should be reflected through one's work.
CO2-PO10	Low	Proper communication has to establish with teacher for having a clear concept. Also while working in teams, communication has no alternatives, the problems must be comprehended properly and worked on effectively. Besides, effective reports and presentations have to be produced.
CO3-PO5	High	Techniques and skills are required for determining a troubleshooting a problem in digital circuit.
CO4-PO10	Medium	Effective communication has to establish with teammates while working in teams for projects. The problems faced during building the project must be comprehended properly and worked on effectively. Besides, effective reports and presentations have to be produced.

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	Lab	Topic
1+2	Lab-1	Design and simulation of half adder, full adder, ripple adder, half subtractor, full subtractor and multiplier, 4-to-1 multiplexer, 16-to-1 multiplexer, 4-to-1 multiplexer using two 2-to-1 multiplexer, crossbar switch and demultiplexers using basic logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
3+4	Lab-2	Design and simulation of 4-to-2 encoder, priority encoder, 2-to-4 decoder, 3-to-8 decoder using two 2-to-4 decoders, 4-to-16 decoder built using a decoder tree, 4-to-1 multiplexer built using a decoder using logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
5+6	Lab-3	Design and simulation of half adder, full adder, ripple adder, half subtractor, full subtractor and multiplier, 4-to-1 multiplexer, 16-to-1 multiplexer, 4-to-1 multiplexer using two 2-to-1 multiplexer, crossbar switch and demultiplexers using basic logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
7+8	Lab-4	Design and simulation of 4-to-2 encoder, priority encoder, 2-to-4 decoder, 3-to-8 decoder using two 2-to-4 decoders, 4-to-16 decoder built using a decoder tree, 4-to-1 multiplexer built using a decoder using logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
9+10	Lab-5	Design and simulation of half adder, full adder, ripple adder, half subtractor, full subtractor and multiplier, 4-to-1 multiplexer, 16-to-1 multiplexer, 4-to-1 multiplexer using two 2-to-1 multiplexer, crossbar switch and demultiplexers using basic logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
11+12	Lab-6	Design and simulation of 4-to-2 encoder, priority encoder, 2-to-4 decoder, 3-to-8 decoder using two 2-to-4 decoders, 4-to-16 decoder built using a decoder tree, 4-to-1 multiplexer built using a decoder using logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.
13+14	Lab-7	Design and simulation of half adder, full adder, ripple adder, half subtractor, full subtractor and multiplier, 4-to-1 multiplexer, 16-to-1 multiplexer, 4-to-1 multiplexer using two 2-to-1 multiplexer, crossbar switch and demultiplexers using basic logic gates, Schematic Capture and Verilog followed by implementation in FPGA board.

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Lab Participation and Report	20%	CO1	P3
			CO2	P3
			CO 3	A3
			CO4	P7
	Labtest	30%	CO1	P3
			CO2	P3
			CO 3	A3
			CO4	P7
	Project and Presentation	25%	CO4	P7
Lab Quiz		25%	CO 1	P3
			CO 2	P3
			CO 3	A3
			CO4	P7
Total Marks		100%		

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

REFERENCE BOOKS
1. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, 3rd edition 2014. 2. Ronald J Tocci, Digital Systems, Pearson Education, 10th edition 2009. 3. Moris mano, Digital Design, Prentice Hall of India, 3rd edition, 2002.
REFERENCE SITE

GELM-275: Leadership and Management

COURSE INFORMATION			
Course Code Course Title	: GELM-275 : Leadership and Management	Lecture Contact Hours Credit Hours	: 2.00 : 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
1. To introduce different management functions and approaches. 2. To expose students to different views and styles of leadership 3. To understand how an organization functions collaboratively with managers and engineers. 4. To understand various personality traits and its impact on leadership and management. 5. 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	By knowing the basic concepts of leadership and management skills, engineering knowledge will be enriched
CO2-PO11	High	Management of an organisation and cost will be learned to achieve leader's targets
CO3-PO12	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 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	**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.	Class Test 1
	Lec 2	**Management Fundamentals:** Definition of management & manager; levels of management; management functions and skills; Mintzberg's managerial roles; Henri Fayol's management principles; strategic management.	
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	**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.	
	Lec 10	**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	**Control:** Controlling process; controlling for organizational performance; types of control: (feed-forward, feedback & concurrent); balanced scorecard; contemporary issues in control; workplace concern & workplace violence.	
	Lec 12	**Change and Innovation:** Change and innovation; internal and external for change; changing process; creativity vs innovation.	
7	Lec 13	**Case Study – II : Planning and Goal Setting; A Managerial Approach: Engineer as Great Managers (Interactive Discussions in the Class)**	
	Lec 14	**Attitude:** Components of Attitude; behavior model and characteristics model; behavior vs. attitude; job attitude; job involvement; job satisfaction and customer satisfaction.	
8	Lec 15	**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).	Mid Term Exam / Project
	Lec 16	**Perception and Individual Decision Making**: Factors influencing perception; attribution theory; errors/biases in	

		attribution	
9	Lec 17	**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.	
	Lec 18	**Case Study – III : A Case on Decision Making – Involves both leadership and managerial skills (Interactive Discussion in the Class)**	
10	Lec 19	**Understanding Work Team:** Work group; work team; problem solving team; self-managed work team; cross functional team; virtual team; team effectiveness; team challenges.	
	Lec 20	**HR Management:** Process of Human Resource Planning; forecasting demand for labor; staffing.	
11	Lec 21	**HR Management:** Internal supply of labor; performance appraisal.	
	Lec 22	**Operations Management:** Project managing basics; goals and boundary of project; WBS; scheduling a project.	
12	Lec 23	**Operations Management:** Demand and supply forecasting; inventory control.	Class Test 2
	Lec 24	**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	**Information Technology and Management:** Management Information System (MIS); Enterprise Resource Planning (ERP) - For introductory knowledge.	
	Lec 28	**Revision**	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO 1	C1-C2, P1
			CO 2	C1-C2
	Presentation	5%	CO 1	C1-C2, P1, A1
	Mid term	15%	CO 1	C1-C2, P1, A1
			CO 2	C1-C2, P1-P2, A1-A2
			CO 3	C1-C2, P1-P2, A1-A2
Final Exam		60%	CO 1	C1-C2, P1, A1
			CO 2	C1-C2, P1-P2, A1-A2
			CO 3	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 Course Title	: MATH-207 : Complex Variable and Statistics	Lecture Contact Hours Credit Hours	: 3.00 : 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 the basic concepts and 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 variable and statistics.

OBJECTIVE

1. To understand basic knowledge of Complex Number system on real and complex function and also be expert in recognizing about frequency distribution, Graphical representation of data including stem, moments, Skewness, Kurtosis, grouped sampled data, Estimation, Tests of hypothesis.
2. To familiarize the students with the principal terms such as complex variables and statistics.
3. To provide a physical interpretation of our real-life problem, Complex Variable and calculating sample data, skewness, kurtosis and related hypothesis test. And also be expert in applying Complex Variables, statistics and their methods of solution in solving complex 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	**Recognize and define** complex number system, complex variable and **express** the definition and use of the statistical properties.	C1-C2	1		1	T, F, ASG
CO2	**Interpret** the complex function, the integrals of complex functions and **explain** the concept of a frequency distribution, moments, Skewness, Kurtosis, grouped sampled data etc.	C2	1		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, Complex function, differentiation and the Cauchy-Riemann Equations. Line integral of a complex function, Cauchy's Integral Formula, Liouville's Theorem, Taylor's and Laurent's Theorem, Singular 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Recognize and define** complex number system, complex variable and **express** the definition and use of the statistical properties.	H								L			
CO2	**Interpret** the complex function, the	H											

	integrals of complex functions and **explain** the concept of a frequency distribution, moments, Skewness, Kurtosis, grouped sampled data etc.												

(H– High, M- Medium, L-Low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	The knowledge of mathematics and engineering sciences has to be applied to describe the operation of different aspects of engineering problem.
CO1-PO9	Low	If the basic knowledge of complex variables and statistics involves submission as group assignments the practice to work in teams is required.
CO2-PO1	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 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	Complex number system, General functions of a complex variable, Basic operations on complex numbers and variables	
2	Lec 4 Lec 5 Lec 6	Absolute value property and complex conjugate, Limits of a function of complex variable and related theorems	Class Test 1
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	
5	Lec 13 Lec 14 Lec 15	Line integral of a complex function, Liouville's Theorem	Class Test 2
6	Lec 16 Lec 17 Lec 18	Cauchy's Integral Formula, Taylor's Theorem, Laurent's Theorem	
7	Lec 19 Lec 20 Lec 21	Singular Residues, Cauchy's Residue Theorem	
8	Lec 22 Lec 23	Introduction to Statistics, Measures of central tendency, standard deviation	

	Lec 24		Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Chebychev‟s theorem z- cores, Frequency di tribution	
10	Lec 28 Lec 29 Lec 30	Graphica representation of data including stem, Leaf and Box Plot, moments	
11	Lec 31 Lec-32 Lec-33	Treatment of grouped s mpled data, Estimation	Class Test 3
12	Lec-34 Lec-35 Lec-26	Skewnes, 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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1, CO2	C1, C2
	Class Participation	5%	CO1	C1, C2
	Mid term	15%	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)

REFERENCE BOOKS

1. Complex variable (2^{nd}) – Schaum’s Out-line Series by Spiegel (2009).
2. Statistics and Random Processes(2^{nd})- B. Praba, Aruna Chalam and Sujatha.
3. Probability and Statistics for Engineers(9^{th})- Scheaffer & McClave.
4. Schaum's Outline of Probability and Statistics (4^{th})-John J. Schiller Jr, John J. Schiller Jr and Murray R. Spiegel.

REFERENCE SITE

LEVEL-3 SPRING TERM

CSE-301: Database Management Systems

COURSE INFORMATION			
Course Code Course Title	: CSE 301 : 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 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	Describe the basic concepts and appreciate the applications of database systems.	C1-C2, P1	1		1	T, F
CO2	Illustrate the basics of SQL and construct queries using SQL	C2-C3, P3	1,3		1, 3	MT, F
CO3	Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.	C3, C5	1,3		5,6	T, F
CO4	Be familiar with the relational database theory and be able to write relational algebra expressions for queries.	C1-C4, A5	1,3		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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Describe the basic concepts and appreciate the applications of database systems.	H											
CO2	Illustrate the basics of SQL and construct queries using SQL		H										
CO3	Be familiar with a commercial relational database system (Oracle) by writing SQL using the system.			H									
CO4	Be familiar with the relational database theory and be able to write relational algebra expressions for queries.		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-PO1	High	Able to understand the basic concept and application of database systems.
CO2-PO2	High	Apply the SQL concept to solve complex queries using database project.
CO3-PO3	High	Understand the basic concept of commercial project with the help of SQL queries and comparison technique to evaluate the working performance.
CO4-PO2	High	Able to understand and translate the SQL queries in relational algebra expression.
CO5-PO10	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 of database systems	
2	Lec 4 Lec 5	Models: Entity-Relationship model, Relational model	Class Test 1

	Lec 6		
3	Lec 7 Lec 8 Lec 9	Relational algebra	
4	Lec 10 Lec 11 Lec 12	SQL	Class Test 2
5	Lec 13 Lec 14 Lec 15	Advanced SQL, Some applications using SQL	
6	Lec 16 Lec 17 Lec 18	Integrity constraint	
7	Lec 19 Lec 20 Lec 21	Relational database design	
8	Lec 22 Lec 23 Lec 24	File organization and retrieval, file indexing and hashing	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Transaction manager	
10	Lec 31 Lec 32 Lec 33	Concurrency controller, Recovery manager	
11	Lec 28 Lec 29 Lec 30	Security system, Database administration	Class Test 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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C2, P1
			CO 3	C3, C5
			CO 4	C1-C4, A5
	Class Participation	5%	CO5	A2
	Mid term	15%	CO 2	C2-C3, P3
Final Exam		60%	CO 1	C1-C2, P1
			CO 2	C2-C3, P3
			CO 3	C3, 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-302: Database Management Systems Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE 302 : Database Management Systems 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 course is designed to introduce the basic concepts of database, learn how to design database and gain first-hand experience through developing a real-world e- commerce database application in a term project. Also, to learn the design of a database starting from the conceptual design to the implementation of database schemas and user interfaces to a database.			
OBJECTIVE			
1. To introduce the basic concepts of database. 2. Developing a real-world database application. 3. To learn the design of a database starting from the conceptual design to the implementation of database schemas and user interfaces to a database.			

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	1,3	5	PR
CO2	Utilize the database design principles, SQL and PL SQL.	C2, P6	1	5	6	T, CE
CO3	Demonstrate the relational database theory and be able to develop and write relational algebra expressions for queries.	C1-C3, P4	3	2	1	Q
CO4	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; V - Viva; F – Final Exam, CE- Class Evaluation)

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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Demonstrate the knowledge in projects with a commercial relational database system (Oracle) and design a team-based project.									H			
CO2	Utilize the database design principles, SQL and PL SQL.					H							
CO3	Demonstrate the 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	Justification
CO1-PO9	High	Build database project using the basic concept of commercial project, SQL queries and system's performance testing technique.
CO2-PO5	High	Demonstrate the whole project by illustrating with E-R diagram, schema diagram with related PL SQL and SQL queries.
CO3-PO3	High	Apply and relate the relational algebra expression with related SQL queries.
CO4-PO10	High	Develop communication skills through participating in quiz, presentation etc.

TEACHING LEARNING STRATEGY

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

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics	Remarks
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	Join	
7	Lab 7	Constraints	
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	PL/SQL	

ASSESSMENT STRATEGY

Components			Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Class Performance & Observation		10%	CO2	C2, P6
	Project	Project Proposal (15%)	(50%)	CO1	C2-C3, C6
		Project Update and Submission (35%)		CO2	C2, P6
				CO3	C1-C3, P4
				CO4	A2
	Viva/ Quiz		10%	CO2	C2, P6
				CO3	C1-C3, P4
	Online		30%	CO1	C2-C3, C6
				CO2	C2, P6
				CO3	C1-C3, P4
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 Course Title	: CSE 303 : Compiler	Lecture Contact Hours Credit Hours	: 3.00 : 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 functions. To teach the students the basic techniques that underlies the practice of various phases of Compiler construction.

OBJECTIVE

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

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 and understand the role and purposes of compilers in programming languages.	C1, C2			1	T
CO2	Remember, understand and apply the translation from one phase to another in compilation process.	C1,C2,C3			1	T, MT
CO3	Understand and apply the mechanisms of separating lexical, syntactic and semantic analysis into meaningful phases for a compiler.	C2, C3, P4	1	3	2, 3, 4	T, F
CO4	Apply the design procedure of scanners and parsers using tools and build abstract syntax trees in connection with this.	C3	1	3, 5	2, 5, 6	MT, F
CO5	Develop the communication skill by presenting tools on Compilers.	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)

COURSE CONTENT

Introduction: Introduction to compiling; Basic issues; **Lexical analysis and Scanning; 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 runtime storage management; **Code optimization**: The principle sources of optimization, Peephole optimization, Optimization of basic blocks-Loops in flow graphs; Introduction to global data-flow analysis, Code improving transformations.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Remember and understand the role and purposes of compilers in programming languages.	H											
CO2	Remember, understand and apply the translation from one phase to another in compilation process.		H										
CO3	Remember, understand and apply the mechanisms of separating lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation and specify and analyse the lexical, syntactic and semantic structures of advanced language features.			H									
CO4	Remember, understand and apply the design procedure of scanners and parsers using tools and build abstract syntax trees in connection with this.			H									
CO5	Develop the communication skill by presenting tools on Compilers.										M		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Enlarge depth of knowledge through understanding the role and purposes of compilers in programming languages.
CO2-PO2	High	Apply the translation from one phase to another in compilation process.
CO3-PO3	High	Recognize and apply the mechanisms of separating lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation and specify and analyse the lexical, syntactic and semantic structures of advanced language features
CO4-PO3	High	Design scanners and parsers using tools and build abstract syntax trees in connection with this
CO5-PO10	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.

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 31 Lec 32 Lec 33	Variants of Syntax Tree, Directed Acyclic Graphs for Expressions, The Value Number Method for Constructing DAG's, Three Address Code, Addresses and Instructions	
11	Lec 28 Lec 29 Lec 30	Quadruples, Triples, Static Single Assignment Form, Types and Declarations	Class Test 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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1, C2
			CO 2	C1,C2,C3
			CO 3	C2,C3,P4

	Class Participation	5%	CO5	A2
	Mid term	15%	CO 4	C3
Final Exam		60%	CO 2	C1,C2,C3
			CO 3	C2,C3,P4
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 Course Title	: CSE 304 : Compiler Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 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

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

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 and tools to perform syntax-directed translation of a high-level programming language into an executable code.	C1, C2, C3	1	5	5, 6	ASG, CE
CO2	Understand the working mechanisms of lex and yacc compiler for debugging of programs.	C2, P4	1, 5	2	1	T, Q
CO3	Analyze and adapt the new tools and technologies used for designing a compiler.	C4, P6,A2	1	2	6	ASG, Q

(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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Remember, understand and apply the basic techniques of compiler construction and tools to perform syntax-directed translation of a high-level programming language into an executable code.						H						
CO2	Understand the working mechanisms of lex and yacc compiler for debugging of programs.									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-PO6	High	Apply the basic techniques of compiler construction and tools to perform syntax-directed translation of a high-level programming language into an executable code.
CO2-PO9	High	Use the working mechanisms of lex and yacc compiler for debugging of programs
CO3-PO11	High	Adapt 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 Student-Centred Learning	 - 21 -
Self-Directed Learning Non-face-to-face learning in (Lab) Assessment Preparations	 - -
Formal Assessment Continuous Assessment Final Exam	- 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	Symbol Table	3:00 hrs in alternate week

3	Lab-3, 4	Tokenizer	
5	Lab-5, 6	Tokenizer Using Flex	
7	Lab-7, 8	Arithmetic Calculator Using Bison	
9	Lab-9, 10	Arithmetic Calculator Using Bison continued	
11	Lab-11, 12	Intermediate Code Generator (Flex)	
13	Lab-13, 14	Intermediate Code Generator (Bison)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Online	20%	CO2	C2, P4
	Quiz	20%	CO2	C2, P4
			CO3	C4, P6, A2
	Class Participation	10%		
	Offline/ Assignment	30%	CO1	C1-C3
			CO3	C4, P6
	Class Evaluation	20%	CO1	C1-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-305: Microprocessors, Micro-controllers and Assembly Language

COURSE INFORMATION			
Course Code Course Title	: CSE-305 : Microprocessors, Micro-controllers and Assembly Language	Lecture Contact Hours Credit Hours	: 3.00 : 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 basic 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

1. To provide an understanding of microprocessor and microcontroller-based systems and their use in instrumentation, control and communication systems.
2. To familiarize students with the architecture and operation of typical microprocessors and microcontrollers and impart knowledge on the low-level language of microprocessor.
3. To teach the basics of programming and interfacing of common microprocessors and microcontrollers.
4. To investigate in depth the microprocessor-based systems and understand usage of programmable logic controllers.
5. To provide 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's and microcontroller's internal architecture and their operation.	C1-C2	1		1,3,6	T, MT, F
CO2	Analyse how the high-level language structure is converted to low level languages and how a processor executes a program line by line.	C4	1		3	T, F
CO3	Design programs to interface microprocessor to external devices and design 8051 microcontroller-based system.	C3, C6	1		1,3,8	F, ASG
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	1, 7		3	T, MT, F
CO5	Develop communication skills by presenting topics on microprocessors, micro-controllers and assembly Language.	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
Assembly Language: Basic Concepts; System/Processor Architecture; Assembly Language Fundamentals; Memory Segments, Registers, Addressing-modes; 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. **Microprocessors and Micro-controllers**: Introduction to Microprocessor and Microcontrollers, Architectural overview of Microprocessor and its operation, Common instruction types, Addressing modes. **Intel 8086 Microprocessor:** internal architecture, register structure, programming model, addressing modes, instruction set; I/O pin diagram and control signals; I/O port organization and accessing; Cache Memory, TLB Structure; **Memory management in Intel 80X86 family:** Segmentation and Real Mode Memory Management.; Intel 80186, 80386 and 80486 segments register formats; Interrupts and Exception in Intel 80X86 families of processors, type of interrupts, interrupts in real mode and protected mode, interrupts priorities; **Input and Output :** I/O address spaces, Port organization, Memory mapped I/O, Hand-shaking I/O instruction, Keyboard-Display interface Timer handler, **Microcontrollers:** Architecture of 8051, memory organization, special function registers, I/O ports.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Interpret microprocessor's and microcontroller's internal architecture and their operation.	H				H							
CO2	Analyse how the high-level language structure is converted to low level languages and how a processor executes a program line by line.	H	M										
CO3	Design programs to interface microprocessor to external devices and design 8051 microcontroller-based system.	M	M		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.	H	M										
CO5	Develop communication skill by presenting topics on microprocessors, micro-controllers and assembly Language.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1- PO1	High	Interpret microprocessor's and microcontroller's internal architecture and their operation by developing breadth and depth of knowledge and understanding in the respective areas.
CO1- PO5	High	Understand the level of appropriateness and wide usage of microprocessors and microcontrollers in computing systems.
CO2 - PO1	High	Gain depth of knowledge for analysing low level language structure and their execution process.
CO2 – PO2	Medium	Do analysis of how high-level language is converted to low level language and do complex analysis of low-level programs.

CO3 – PO1	Medium	Gain in depth knowledge to design programs to interface microprocessor to external devices and design 8051 microcontroller-based system.
CO3 – PO2	Medium	Gain preliminary experience in complex problem analysis while designing programs to interface devices to microprocessor and microcontroller-based system.
CO3 – PO4	Low	Preliminary level investigation and experimentation while designing programs to interface devices to microprocessor and microcontroller-based system.
CO4 – PO1	High	Gain depth of knowledge in programming for the target microprocessor.
CO4 – PO2	Medium	Do problem analysis for the target microprocessor and assembly programs while applying the gained knowledge.
CO5- PO10	Low	Demonstrate communication skills by presenting on topics as microprocessors, micro-controllers and assembly language.

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 8051, memory organization, I/O ports, Special function registers.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3, Assignment	20%	CO1	C1, C2
			CO2	C4
			CO3	C3, C6
			CO4	C3, C5
	Class Participation	5%	CO5	A2
	Mid term	15%	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. 8051 Microcontroller-Internals, Instructions, Programming& Interfacing by Subrata Ghoshal

REFERENCE SITE

CSE-306: Microprocessors, Micro-controllers and Assembly Language Sessional

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

PRE-REQUISITE
Course Code: Nil Course Title: Ni
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
RATIONALE
This course introduces basics of assembly language programming, microprocessor architecture, and discusses different interfaces and design of systems based on microprocessors and microcontrollers.
OBJECTIVE
1. To achieve practical knowledge on the low-level language of microprocessor. 2. To obtain understanding of microprocessor-based systems and their use in instrumentation, control and communication systems. 3. 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	1,8	E, O, L
CO2	Design basic assembly programs and define where used.	C3, C4, C6		2	1,5	E, O, Q/V
CO3	Interpret how a basic microcomputer works with its associated components.	C1, C2, C4		1	1,6	E, L, Q/V
CO4	Experiment with a basic microprocessor using assembly language in a group project.	C2-C4, C6, A4		1, 3	5	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 16 microcontroller and simulation.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand how low-level languages are implemented and how a processor executes a program line by line.	M			M								
CO2	Design basic assembly programs and define where used.		H	M									
CO3	Interpret how a basic microcomputer works with its associated components.	H				M							
CO4	Experiment with a basic microprocessor using assembly language in a group project.	M		H						H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO1	Medium	Will be able to gain depth of knowledge on how a low-level language is implemented and its execution line by line by a processor.
CO1 – PO4	Medium	Will be able to investigate and experiment with low-level languages by writing programs.
CO2 – PO2	High	Will be able to do complex analysis of assembly programs and define where used.
CO2 – PO3	Medium	Will be able to design solutions to a variety of problems using assembly language.
CO3 -PO1	High	Will gain breadth and depth of knowledge in illustrating how a basic microcomputer works with its associate components.
CO3 – PO5	Medium	Will be able to gain a level of understanding of the appropriateness of microprocessors and associated devices.
CO4 – PO1	Medium	Will develop breadth and depth of knowledge while experimenting with a basic microprocessor using assembly language in a group project.
CO4 – PO3	High	Will be able to develop innovative solutions while working in a microprocessor-based group project.
CO4 – PO9	High	Will gain experience of team work and collaboration while working in the group project.

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Practical / Tutorial / Studio	42
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	-
Revision	-
Assessment Preparations	14
Formal Assessment	
Continuous Assessment	8
Online Exam	1
Lab Test	1
Quiz/Viva	1
Total	74

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab 1	Basic of Assembly Language - Compilation, input, output, variables, basic instructions, memory model, data segment, stack segment, code segment, Input Output Instruction	
2	Lab 2	Flow Control Instruction - Conditional and unconditional jump instructions, If-then-else, case, for loop, while loop	
3	Lab 3	Logic, Shift and Rotate Instructions - AND, OR, XOR, complement, shift left, shift right	
4	Lab 4	Rotate left, rotate right, rotate carry left, rotate carry right, Binary, Hexa Input Output	
5	Lab 5	Stack and Procedure - Push, Pushf, Pop, Popf	
6	Lab 6	Multiplication and Division – Mul, IMul, Div, IDiv	
7	Lab 7	Array and Addressing modes – 1D Array, DUP operator, Addressing-mode, register indirect mode	
8	Lab 8	String Instructions - Moving string, load string, scan string	
9	Lab 9	Compare string File Operations – File errors, opening and closing a file, r/w a file	
10	Lab 10	Basic Idea of MDA 8086 LED	
11	Lab 11	Seven Segment display interface	
12	Lab 12	Operation of DOT matrix using 8086 kit LCD interface with 8086	
13	Lab 13	Keyboard interface with 8086	
14	Lab 14	Motor interface with 8086	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (25%)	Class Evaluation	20%	CO1	C1-C3
			CO2	C3, C4, C6
			CO3	C1, C2, C4
	Class Participation	5%	CO1	C1- C3
			CO2	C3, C4, C6
			CO3	C1, C2, C4
Online Test		20%	CO1, CO2	C1-C4, C6
Lab Test		20%	CO1, CO3	C1-C4
Project Submission		25%	CO4	C2-C4, C6, A4
Quiz / Viva		10%	CO2, CO3	C1-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 Systems

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

PRE-REQUISITE
Course Code: CSE-323 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

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 analyse modern operating systems; concept for virtualization, cloud and multiple processor systems.	C1-C4	1		3	T, MT, F
CO2	Understand and analyse process, thread, memory and file management systems.	C2, C4	1		3	T, MT
CO3	Understand and implement algorithms for process, thread, deadlock and memory management.	C2, C3	2		5	F
CO4	Develop the communication skill by presenting topics on operating systems.	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

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 of some operating systems.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 topics on operating systems.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Increase breadth & depth of knowledge through Classifying, identifying and analysing various aspect of modern operating systems.
CO2-PO2	High	Understand and solve various complex problems by analysing process, thread, memory and file management system.
CO3-PO3	High	Understand and implement algorithms for process, thread, deadlock and memory management which solutions have previously been identified and coded.
CO4-PO10	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 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	Job and process scheduling, scheduling levels, objective and criteria CPU scheduling algorithms	

	Lec 9		
4	Lec 10 Lec 11 Lec 12	Process coordination, critical section problems, semaphores,	Class Test 2
5	Lec 13 Lec 14 Lec 15	Language constructs, classical problems of process coordination, Inter-process communication, message and mailbox etc.	
6	Lec 16 Lec 17 Lec 18	Memory management memory allocation schemes, Paging and segmentation, virtual memory	
7	Lec 19 Lec 20 Lec 21	Page replacement strategies, working sets, demand paging	
8	Lec 22 Lec 23 Lec 24	File system functions file organization logical and physical file maps, tree structure filesystems	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	I/O programming Device management techniques. Interrupts processing parallel processing.	
10	Lec 31 Lec 32 Lec 33	Secondary storage management, disk scheduling algorithms	
11	Lec 28 Lec 29 Lec 30	Space allocation,catalogs, file access control mechanism	Class Test 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 of some operating systems.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C4
			CO 2	C2, C4
	Class Participation	5%	CO4	A2
	Mid term	15%	CO 3	C2, C3
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 (4^{th}) - Andrew S. Tanenbaum; Prentice Hall
2. Operating Systems: Internals and Design Principles – (9^{th}) -William Stallings

3. Operating System concepts - A. Silberschatz, P.B. Galvin, Greg Gagne
REFERENCE SITE

CSE-308: Operating Systems Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE 308 : Operating System Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 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 development 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 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	8	T, Q
CO2	Apply and modify algorithms for process, thread and memory management through group project work	C3, A5		2	6	ASG, Q
CO3	Develop the communication skill by presenting topics on operating systems	P3, A4		2	2	R,Q
CO4	Enhance security of Windows and Unix like operating systems	C4, A2		4	8	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: Development of Linux Operating System, 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; **Security of Windows and UNIX like OS:** hardening and security issues.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 topics on operating systems										H		
CO4	Enhance security of Windows and Unix like operating systems												H

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO4	High	Understand and respond major operating systems like Windows and Unix like OS through investigation and experimentation
CO2-PO9	High	Apply and modify algorithms for process, thread and memory management as a group project work.
CO3-PO10	High	Develop the communication skill by presenting topics on operating systems
CO4-PO12	High	Enhance security of Windows and Unix like operating systems as a process of continuing learning.

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 and implementation in Memory management	
9	Lab-9,10	Inter process communication and Process scheduling algorithms and implementation	
11	Lab-11,12	Mutual exclusion and deadlock algorithms and implementation	

13	Lab- 13,14	Security of Windows and UNIX like OS, hardening and security issues	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test and Assignment	30%	CO1	C2, A2
			CO2	C3, A5
			CO4	C4, A3
	Class Participation	20%	CO3	P3, A4
	Presentation	10%	CO3	P3, A4
Final Exam (Quiz + Online Test)		40%	CO1, CO2, CO4	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 Course Title	: CSE-317 : Data Communication	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 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.
3. 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	-	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	2	3	Mid Term Exam, F

CO3	Identify and analyze principles of security, performance and reliability of different networks.	C1, C4	2,3	5	2,6	Mid Term Exam, F
CO4	Develop the communication skill by presenting topics on data communication	A2	-	-	5	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

Introduction: Communication Models, Communication Network Standards and Organization, Introduction to TCP/IP Models. **Data Transmission Basics:** Analog and Digital Data, Spectrum and Bandwidth, Transmission Impairments, Data Rate, and Channel Capacity. **Data Encoding:** NRZI, Manchester and Differential Manchester Encoding, ASK, FSK, PSK, QPSK, QAM Encoding, Pulse Code Modulation, Delta Modulation. **Data Transmission:** Asynchronous and Synchronous Data Transmission Techniques. **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. **Error Detection and Correction:** Redundancy, Parity Cheeks, Hamming Distance, CRC Error Correction, Checksum. **Multiple Access:** ALOHA, CSMA, CSMALCD, CSMALCA, FDMA, TDMA, CDMA. **Wired LANs:** Ethernet, IEEE Standards, Standard Ethernet, IEEE 802.11, Bluetooth. **Connecting Devices:** Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Gateway, Backbone Networks, Virtual LANs.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
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										
CO4	Develop the communication skill by presenting different topics on data communication										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Depth of engineering knowledge can be accomplished by understanding the data transmission system and its components and working principles.
CO2-PO2	High	Complex problem analysis skill can be developed by analyzing different data encoding techniques.
CO3-PO2	High	Evaluation of engineering system can be perceived through analyzing different security and performance measure of communication networks.
CO4-PO10	Low	Communication skill on engineering problem can be developed by discussing and presenting different topic on data communication.

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 the course, Introduction to data communication and networks, The Internet, Network protocols and standards.	Class Test-1
2	Lec 4 Lec 5 Lec 6	Network models, Layered tasks, OSI Model, Layers in the OSI model, TCP/IP protocol suite, Network addressing	
3	Lec 7 Lec 8 Lec 9	Analog and digital data, Periodic analog signals. Digital signals, Transmission impairment, Data rate limits, Networks Performance measurement.	
4	Lec 10 Lec 11 Lec 12	Introduction to digital transmission, Digital-to-Digital conversion (Line coding), Digital-to-Digital conversion (Block coding, Scrambling), Analog-to-Digital conversion (Pulse Code Modulation, Delta Modulation)	Class Test-2
5	Lec 13 Lec 14 Lec 15	Transmission modes, Parallel transmission, Serial transmission, Aspects of Digital-to-Analog conversion, Amplitude Shift Keying, Frequency Shift Keying,	
6	Lec 16 Lec 17 Lec 18	Phase Shift Keying, Quadrature Amplitude Modulation, Analog-to-Analog Conversion, Amplitude Modulation, Frequency Modulation, Phase Modulation	
7	Lec 19 Lec 20 Lec 21	Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing, Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	Introduction to Error Detection and Correction, Error detection and correction in block coding, Linear Block Codes and Checksum	
9	Lec 25 Lec 26 Lec 27	Transmission media, Guided and unguided media, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Radio Waves, Microwaves, Infrared	
10	Lec 28 Lec 29 Lec 30	Introduction to Multiple Access, Random access. ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMAlCD), and Carrier Sense Multiple Access with Collision Avoidance (CSMAlCA)	Class Test-3
11	Lec 31 Lec 32	Channelization, Frequency-Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code-Division	

	Lec 33	Multiple Access (CDMA)	
12	Lec 34 Lec 35 Lec 36	Wired LANs: Ethernet, IEEE Standards (Physical and Data Link Layer), Standard Ethernet (Physical layer and MAC sublayer)	
13	Lec 37 Lec 38 Lec 39	IEEE 802.11, Bluetooth, Connecting devices (Passive Hubs, Repeaters, Active Hubs)	
14	Lec 40 Lec 41 Lec 42	Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Backbone networks (Bus Backbone, Star Backbone, Connecting Remote LANs), Virtual LANs	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO3	C1, C4
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C4, P1
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 Course Title	: CSE-318 : Data Communication Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

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

1. To familiarize students with different network simulation technologies.
2. To impart practical knowledge on different signal modulation/demodulation and multiplexing techniques.
3. To bestow the quality of each data transmission methods using both signal processing devices and lab

software.

4. 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, P6	3	1	2, 4	Class Assessment, Online, Q
CO2	Compare each data transmission methods using both signal processing devices and lab software.	C2, C5, P7	3	2	2	Class Assessment, Viva, Q
CO3	Apply amplitude, frequency and time division multiplexing techniques to share network bandwidth among multiple users.	C2-C4	1, 2	3	3	Online, Viva, Q
CO4	Develop the empirical knowledge on data link layer fundamentals, e.g., error detection, correction and flow control techniques.	P4, C5, C6	2	5	5, 6	Class Assessment, Online, Viva, 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 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

o.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	
1	Adopt data communication simulation technologies.					H							
2	Compare each data transmission methods using both signal processing devices and lab software.							H					
3	Apply amplitude, frequency and time division multiplexing techniques to share network bandwidth among multiple users.						M						
4	Develop the empirical knowledge on data link layer fundamentals, e.g., error detection, correction and flow control techniques.												

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO5	High	Use of modern tools can be accomplished by adopting simulating technologies like MATLAB to network simulation.
CO2-PO7	High	Sustainability of a solution can be realized through comparing them by both physical lab experiment and software simulation.
CO3-PO6	Medium	Exercising engineering knowledge and responsibility could be made by applying different multiplexing technique in the computer networks to optimize the resources.
CO4-PO12	Medium	Communication skill on engineering problem can be developed by discussing and presenting different topic on data communication.

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	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	Lab	Topics	Remarks
1	Lab - 1, 2	Introduction to MATLAB and signal processing libraries.	3:00 hrs in alternate week
3	Lab - 3, 4	Amplitude Modulation, Frequency Modulation	
5	Lab - 5, 6	Delta Modulation and Demodulation.	
7	Lab - 7, 8	Line Coding: DSB-SC and SSB Demodulators	
9	Lab - 9, 10	ASK, PSK, FSK	
11	Lab - 11, 12	Code-division multiple access (CDMA)	
13	Lab - 13, 14	Error Detection and Correction	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms 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
	Viva	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 Course Title	: CSE 309 : Computer Network	Lecture Contact Hours Credit Hours	: 3.00 : 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 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		1, 3	T, F
CO2	Illustrate knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.	P4	1		2	MT
CO3	Design network routing for IP networks using different routing protocol.	C3-C6	5		6	F
CO4	Develop the communication skill by presenting topics on Computer networking.	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

Introduction, What Is **Network**, Delay, Loss, and Throughput in Packet Switched Networks, **Protocol Layers**, Protocol hierarchies; **Application Layer** Principles of Network Applications, The Web and HTTP, File Transfer, **Data link control**: HLDC; DLL in Internet; DLL of ATM; LAN Protocols: Standards IEEE 802; Hubs, Bridges, and Switches, FDDI, Fast Ethernet; **Routing** Algorithm; Internetworking, WAN; Fragmentation; Firewalls; IPV4, IPV6, ARP, RARP, Mobile IP, Network layer of ATM; **Transport Protocols**; **Transmission Control Protocol**: Connection Management, Transmission Policy, **Congestion Control**, Timer Management; **UDP**; AAL of ATM; wireless networks, mobile computing, and high speed networks; Gigabit Ethernet; Domain Name System: Name servers; Email and Its privacy; SNMP; HTTP; World Wide Web; **Network security**: Cryptography, DES, IDEA, public key algorithm; Authentication; Digital signatures, Principles of Reliable Data Transfer, FTP.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understanding different types of networks, the organization of computer networks, proper placement of different layers of ISO model and factors influencing network development.	H											
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 protocol.			H									
CO4	Develop the communication skill by presenting topics on Computer networking.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Able to understand different types of networks, the organization of networks, different layers of ISO model and factors influencing network development.
CO2-PO2	Medium	Apply the knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission.
CO3-PO3	High	Able to design network routing for IP networks using different routing protocol.
CO4-PO10	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 What Is the Internet, Network Edge, Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Protocol Layers and Their Service Models, Networks Under Attack, History of Computer Networking and the Internet	Class Test 1

2	Lec 4 Lec 5 Lec 6	Application Layer Principles of Network Applications, The Web and HTTP, File Transfer	
3	Lec 7 Lec 8 Lec 9	Electronic Mail in the Internet, DNS, Peer-to-Peer Applications, Socket Programming	
4	Lec 10 Lec 11 Lec 12	Multimedia Digitizing Audio And Video, Audio And Video Compression, Streaming Stored Audio/Video, Streaming Live Audio video, Real-Time Interactive Audio video, RTP, RTCP, Voice Over IP Review Class	Class Test 2
5	Lec 13 Lec 14 Lec 15	Transport Layer Process to Process Delivery: UDP, TCP,SCTP	
6	Lec 16 Lec 17 Lec 18	Congestion Control and Quality of Service	
7	Lec 19 Lec 20 Lec 21	Network Layer IPv4 Addresses, Internet Protocol, Internetworking, IPv4	Mid Term Exam
8	Lec 22 Lec 23 Lec 24	IPv6 Address, Transition from IPv4 to IPv6, Address Mapping, ICMP	
9	Lec 25 Lec 26 Lec 27	Network Layer IGMP, ICMPV6, Delivering, Forwarding and Routing Delivery, Forwarding	
10	Lec 31 Lec 32 Lec 33	Unicast Routing Protocols Multicast Routing Protocols	
11	Lec 28 Lec 29 Lec 30	Data Link Layer Services, Error-Detection and Correction, Parity Checks, Check summing Methods, CRC	
12	Lec 34 Lec 35 Lec 36	Multiple Access Links and Protocols, Switched Local Area Network, Link Virtualization, Data Center Networking, Retrospective	Class Test 3
13	Lec 37 Lec 38 Lec 39	Wireless and Mobile Networks Wireless Links and Network Characteristics, Cellular Internet Access, Mobility Management: Principles, Mobile IP, Managing Mobility in Cellular Networks, Wireless and Mobility: Impact on Higher Layer Protocols	
14	Lec 40 Lec 41 Lec 42	Network Security Cryptography, Message Integrity and Digital Signatures, End-Point Authentication, Securing E-Mail, Securing TCP Connections: SSL, Network-Layer Security: IPsec and Virtual Private Networks, Firewalls and Intrusion Detection Systems	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1, C2
	Class Participation	5%	CO4	A2
	Mid term	15%	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 Course Title	: CSE 310 : Computer Network 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
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. Detect vulnerability of network by capturing and analyzing real-time packets. 3. Achieve a basic idea about Cisco Packet tracer, Wire Shark, 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 networks and create server client communication.	C2, C4	1, 3		1	Q
CO2	Design and simulate present contemporary and new protocols of computer networks in Cisco Packet Tracer and NS2.	C6, P3	1, 3		5	T, ASG
CO3	Applying and analyzing different routing protocols of computer networks in physical devices.	C3, C4	3		2	T
CO4	Capturing and analyzing real-time packets to detect vulnerability of network using Wire Shark.	C4, A2	4		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)

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 and NS2.			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-PO1	High	Understand and analyze different types of computer networks and create server client communication.
CO2-PO3	High	Simulate present contemporary and new protocols of computer networks in Cisco Packet Tracer and NS2
CO3-PO2	High	Apply and analyze different routing protocols of computer networks in physical devices.
CO4-PO5	High	Analyze real-time packets to detect vulnerability of network using Wire Shark.

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	 - - -
Formal Assessment Continuous Assessment Final Examination	 4 2 X 3=6
Total	52

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Week	**Topics**	**Remarks**
1	IP Addressing, Basic Configuration of Cisco Packet Tracer	
2	Socket Programming	
3	Basic Network Configuration (Static) Data	
4	Variable Length Subnet Mask (VLSM)	
5	RIP, EIGRP	
6	Open Shortest Path First (OSPF)	
7	Dynamic Host Configuration Protocol (DHCP)	

8	Physical Network Interface Connection/ Router	
9	Switch Configuration	
10	Access Control List (ACL)	
11	VLAN	
12	Inter-VLAN, VTP	
13	Information Gathering using Wire shark	
14	Introduction to NS2	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Final Exam	Online Test	25%	2	C6, P3
		25%	3	C3, C4
	Quiz	10%	1,4	C2, C4, A2
Continuous Assessment (40%)	Class Performance	10%	2	C6, P3
	Class Assessment	30%	2	C6, P3
Total Marks		100%		

(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 Course Title	: CSE-315 : Digital System Design	Lecture Contact Hours Credit Hours	: 2.00 : 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

1. To provide a basic idea of the structure and interface of different components of Digital Computer Systems.
2. To design different components of basic computer.
3. To understand and design microprocessor of basic computer.

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,	C4-C6	3	1	5	T, F

	Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory.					
CO2	Design a fully customized microprocessor with special features.	C4-C6, P3	3	1	5	MT, F
CO3	Understand and describe how to design a digital system using various methods.	C2, C5			1, 2, 3, 4	T, ASG, F
CO4	Develop the communication skill by presenting topics on digital system design.	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

Design using MSI and LSI components; Combinational and sequential circuit design with PLA's, Design of memory subsystem using SRAM and DRAM; Design of various **components of a computer**: Accumulator design, Shifter design, ALU, **memory** and control unit – hardwired and **micro-programmed**, Microprocessor based designs; Design using special purpose controllers. Introduction to **Simple As Possible** (Microprocessor)- Architecture, Instruction Set, Design, Microprogramming, SAP-1, SAP-2; Introduction to Embedded Systems.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Design different components of a microcomputer like Accumulator, Shifter, ALU, RAM, Scratchpad Memory, 2-port Memory.			H									
CO2	Design a fully customized microprocessor with special features.			H									
CO3	Understand and describe how to design a digital system using various methods.		H										
CO4	Develop the communication skill by presenting topics on digital system design.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO3	High	Analyse, evaluate and design complex components of a microcomputer to meet desired specifications and needs.
CO2-PO3	High	Analyse and design a fully customized microprocessor with special features we need the ability to design a complex computing system to meet desired specifications.
CO3-PO2	High	Understand and describe how to design a digital system using various methods, we need the ability to design and conduct experiments, as well as to analyse and interpret data including hardware and software components.
CO4-PO10	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	28
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	28

Revision Assessment Preparations	14 14
Formal Assessment Continuous Assessment Final Examination	 2 2
Total	88

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	Design using MSI and LSI components	Class Test 1
2	Lec 3 Lec 4	Combinational and sequential circuit design with PLA's	
3	Lec 5 Lec 6	Design of memory subsystem using SRAM and DRAM	
4	Lec 7 Lec 8	Design of various components of a computer: Accumulator design	
5	Lec 9 Lec 10	Design ALU	Class Test 2
6	Lec 11 Lec 12	Shifter design, memory	
7	Lec 13 Lec 14	Control unit - hardwired and micro-programmed, Microprocessor based designs	
8	Lec 15 Lec 16	Design using special purpose controllers	
9	Lec 17 Lec 18	Introduction to Simple As Possible (Microprocessor)-Architecture, Instruction Set	Mid Term Exam
10	Lec 19 Lec 20	Simple As Possible-1: Design	
11	Lec 21 Lec 22	Simple As Possible-1: Microprogramming	
12	Lec 23 Lec 24	Simple as Possible-2: Architecture, Instruction Set, Design	
13	Lec 25 Lec 26	Simple as Possible-2: Microprogramming	
14	Lec 27 Lec 28	Introduction to Embedded Systems	

ASSESSMENT STRATEGY

			CO	Blooms Taxonomy
Components		Grading		
Continuous Assessment (40%)	Test 1-2	20%	CO1	C4, C6
			CO3	C2
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C4-C6
Final Exam		60%	CO1	C4-C6
			CO2	C4-C6, P3
			CO3	C2, C5
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
3. Digital Design and Computer Architecture - David Harris and Sarah Harris

REFERENCE SITE

CSE-316: Digital System Design Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-316 : Digital System Design Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 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 computer and fully customized microprocessor of basic computer.

OBJECTIVE

1. To design different components of basic computer
2. To understand and design microprocessor of basic computer.

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 the microprocessor using the concept of computer system design.	C4-C6	1, 3	1	5	PR, Q, R, T, V
CO2	Implement combinatorial and sequential system using simulation software.	C6	1, 3		6	PR, V
CO3	Design and implement a customized microprocessor with special features and simulate	C4-C6, P4	2, 3	2		PR, Q, R, V, Pr

	it using simulation software with team presentation.					

(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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Design different components of the microprocessor using the concept of computer system design.			H									
CO2	Implement combinatorial and sequential system using simulation software.					H							
CO3	Design and implement a customized microprocessor with special features and simulate it using simulation software with team presentation.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING:

Mapping	Level	Justifications
CO1-PO3	High	Analyse, evaluate and design different complex components of a microcomputer to meet desired specifications and needs.
CO2-PO5	High	Implementing combinatorial and sequential system using simulation software we need the ability to use the techniques, skills, and modern engineering tools which is necessary for engineering practice.
CO3-PO9	High	Practice to work in teams if the designing and implementation of a customized microprocessor with special features involves submission as group 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 Project Preparations	- - 21
Formal Assessment Continuous Assessment Final Exam	2 3
Total	47

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 digital system and software simulation, Problem definition of Project: Design of a Shifter	3:00 hrs in alternate week
3	Lab-3,4	Submission of Shifter (Software Simulation and Hardware Implementation), Problem definition of Project: Design of an ALU	
5	Lab-5,6	Design submission and software simulation of ALU	
7	Lab-7,8	Final project submission of ALU with report, Problem definition of Project: Design of a 4-bit microprocessor	
9	Lab-9,10	Design submission of 4-bit microprocessor	
11	Lab-11,12	Hardware implementation submission of 4-bit microprocessor without control unit, Full software simulation of 4-bit microprocessor	
13	Lab-13,14	Final project submission of 4-bit microprocessor with report	

ASSESSMENT STRATEGY

Components			Grading	CO	Blooms Taxonomy
Continuous Assessment (80%)	Design	Design	10%	CO 1	C4-C6
				CO 2	C6
		Simulation	10%	CO 2	C6
				CO 3	C4-C6, P4
	Implementation	-	20%	CO 1	C4-C6
				CO 3	C4-C6, P4
	Viva/ Presentation	-	10%	CO 1	C4-C6
				CO 2	C6
				CO 3	C4-C6
	Class Assessment	-	10%	CO 1	C6
	Class Participation	-	10%	CO 1	C4-C6
				CO 3	C4-C6
	Report	-	10%	CO 1	C4-C6
				CO 3	C4-C6
Quiz			20%	CO 1	C4-C6
				CO 2	C6
				CO 3	C4-C6
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

PRE-REQUISITE
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 the 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 applying the fundamentals of software development process.	C1- C3	1		3	T, F
CO2	Analyse the user requirements, and designing different kind of system and architectural models for building software systems.	C4, C6	2		4, 5	T, MT
CO3	Develop testing mechanisms for assuring software quality including the dependability and availability.	C4	1		8	F
CO4	Develop the communication skill by presenting topics on software engineering.	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

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, behavioural 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 dependability and 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand and applying the fundamentals of software development process.	H											
CO2	Analyse the user requirements, and designing different kind of system and architectural models for building software systems.		M	M									
CO3	Develop testing mechanisms for assuring software quality including the dependability and availability.				M								
CO4	Develop the communication skill by presenting topics on software engineering.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Acquire a strong level of knowledge regarding software engineering by understanding the fundamental concept of software engineering like software engineering principles, software quality, software development process, agile development process.
CO2-PO2, PO3	Medium, Medium	Understand the analysis and interpret the system requirements and software development fundamentals to reveal the user requirements followed by designing the software architecture and system model; as well as acquire the knowledge regarding the ability to design, analysis and interpret a software a system to design the complex system architecture and system models.
CO3-PO3	Medium	Develop complex software systems in accordance with the specifications in order to assure the quality, dependability and availability of a software through an in-depth knowledge of software testing mechanisms.
CO5-PO10	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	1	Introduction to software engineering	Class Test 1
	2	Introduction to software engineering (Contd.)	
	3	Introduction to software engineering (Contd.)	
2	4	Professional SW development ethics	
	5	Professional SW development ethics (Contd.)	
	6	Professional SW development ethics (Contd.)	
3	7	Software processes	
	8	Software processes (Contd.)	
	9	Software processes (Contd.)	
4	10	Agile software development	Class Test 2
	11	Agile software development (Contd.)	
	12	Agile software development (Contd.)	
5	13	Requirements engineering	
	14	Requirements engineering (Contd.)	
	15	Requirements engineering (Contd.)	
6	16	Requirements engineering	
	17	Requirements engineering (Contd.)	
	18	Requirements engineering (Contd.)	
7	19	System modeling	Mid Term Exam
	20	System modeling (Contd.)	
	21	System modeling (Contd.)	
8	22	System modeling	
	23	System modeling (Contd.)	
	24	System modeling (Contd.)	
9	25	Architectural design	
	26	Architectural design (Contd.)	
	27	Architectural design (Contd.)	
10	28	Design and implementation	
	29	Design and implementation (Contd.)	
	30	Design and implementation (Contd.)	
11	31	Software testing	Class Test 3
	32	Software testing (Contd.)	
	33	Software testing (Contd.)	
12	34	Software quality	
	35	Software quality (Contd.)	
	36	Software quality (Contd.)	
13	37	System dependability and reliability engineering	
	38	System dependability and reliability engineering (Contd.)	
	39	System dependability and reliability engineering (Contd.)	
14	40	Introduction to project management	
	41	Introduction to project management (Contd.)	
	42	Introduction to project management (Contd.)	

ASSESSMENT STRATEGY

		CO	Blooms Taxonomy
Components	Grading		

Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO2	C4, C6
	Class Participation	5%	CO4	A2
	Mid term	15%	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. 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 Course Title	: CSE-320 : Software Engineering Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 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 modelling 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.	C3, P4	1	3	6	PR, Pr, R, Viva
CO2	Analyse the user requirements and design the system models.	C4, P1	2	1	5	PR, Pr, R, Viva

CO3	Use software prototyping tool and develop system prototypes and test cases to evaluate the prototypes.	C5, C6, P4	1	1	4	PR, Pr, R, Viva
CO4	Develop the communication skill by presenting topics on software engineering sessional.	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

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 modelling:** 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand and apply software development process.	H											
CO2	Analyse the user requirements and design the system models.		H	M									
CO3	Use software prototyping tool and develop system prototypes and test cases to evaluate the prototypes.			M	L	L							
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-PO1	High	Acquire a strong level of knowledge regarding the applicability of software development process through the fundamental concept of software engineering.
CO2-PO2, PO3	High, Medium	Analyse and interpret user needs as well as develop system models accordingly for complex computing systems for requirement analysis.
CO3-PO2, PO3, PO4	Medium, Low, Low	Conduct experiments to understand whether the prototypes are able to meet users' desired specifications for developing system prototypes and evaluating those by creating appropriate test cases using modern engineering and IT tools for prototyping.
CO4-PO10	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 Final Project Assessment and Viva	 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	Introducing software development process and models and discussion on possible innovative project ideas	
3	Lab-3,4	Conducting the requirements engineering following the information gathering techniques on the selected projects	
5	Lab-5,6	Designing the system architecture and context diagram for the selected projects [Using the Microsoft Visio tool]	
7	Lab-7,8	Designing the system models using unified modelling language for the selected projects [Using the Microsoft Visio tool]	
9	Lab-9,10	Developing prototypes for the selected projects and design implementation using [Using the Balsamiq tool]	
11	Lab-11,12	Developing the test cases and evaluating the prototypes	
13	Lab-13,14	Final documentation and project submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Report/Documentation	20%	CO1	C3, P4
			CO2	C4, P1
			CO3	C5, C6, P4
	Class Participation	5%	CO4	A2
	Presentation	15%	CO1	C3, P4
			CO2	C4, P1
			CO3	C5, C6, P4
Final Project Assessment and Viva		60%	CO1	C3, P4
			CO2	C4, P1
			CO3	C5, C6, P4
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-I

COURSE INFORMATION			
Course Code Course Title	: CSE-364 : Software Development Project-I	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 Individual Software Development Project – I course is designed to make its learners able to solve advanced level industry problems and develop real time projects professionally.

OBJECTIVE

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

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 advance programming language and technique to solve complex problems, to design real time projects and to increase the depth of knowledge in programming.	C3-C4, C6, P7	1	1	5	PR, Q
CO2	Practice good programming style and identify and adapt to the changes in style of developing and maintaining systems.	C2, C5, P6	5	5	6	PR
CO3	Illustrate practical knowledge to identify the relative merits of different information architectural designs, programming constructs and data structures.	C2-C4, C6, A5	3	2	2	PR, Q
CO4	Able to develop industry level web based applications individually.	C1-C6	1		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

Intro to Web development: Information about architectural design of web systems, Show Sample Projects; **Frontend**: Front end development of Web based Systems using HTML & CSS, Frontend development with frameworks and project version control with git, Intro to Bootstrap; **Frontend-backend platform:** Intro to Codeigniter, Laravel; **Intro to java script**: Dynamic web front end programming, concurrent and asynchronous JS programming, debugging a web system with JavaScript; **Database:** Intro to NoSQL Databases, User access control using Firebase. Project integration, Intro to collection, Data store, Retrieval and hosting using Firebase and JavaScript.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify advance programming language and technique to solve complex problems, to design real time projects and to increase the depth of knowledge in programming.			H									
CO2	Practice good programming style and identify and adapt to the changes in style of developing and maintaining systems.					H							
CO3	Illustrate practical knowledge to identify the relative merits of different information architectural designs, programming constructs and data structures.	H											
CO4	Able to develop industry level web-based applications individually.									H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO3	High	In order to design solutions and systems for complex engineering problems, one needs to know how to identify techniques and design real time projects.
CO2 – PO5	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 – PO1	High	To apply the engineering knowledge to solve complex problems one need to know how to illustrate practical knowledge of different information architectural designs, programming constructs and data structures.
CO4-PO10	High	In order to function effectively as an individual, one needs to know how to develop industry level web based applications individually.

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	Information about architectural design of web systems, Show Sample Projects	
2	Lab 2	Front end development of Web based Systems using HTML & CSS	
3	Lab 3	Frontend development with frameworks	
4	Lab 4	Project version control with git.	

5	Lab 5	Intro to Bootstrap, Codeigniter, Laravel	
6	Lab 6	Dynamic web front end programming, concurrent and asynchronous JS programming	
7	Lab 7	Debugging a web system with JavaScript	
8	Lab 8	Intro to NoSQL Databases	
9	Lab 9	Intro to collections, Data store, Retrieval using Firebase and JavaScript.	
10	Lab 10	Intro to hosting using Firebase and JavaScript.	
11	Lab 11	User access control using Firebase.	
12	Lab 12	Deployment of web apps	
13	Lab 13	Project integration.	
14	Lab 14	Project Testing.	

ASSESSMENT STRATEGY

Components			Grading	CO	Blooms Taxonomy
Continuous Assessment (100%)	Class Performance & Observation		10%	CO1	C3-C4, C6, P7
	Project	Project Proposal (10%)	70%	CO1	C3-C4, C6, P7
		Project update-1(20%)			
		Project Final Submission (40%)		CO2	C2, C5, P6
				CO3	C2-C4, C6, A5
				CO4	C1-C6
	Quiz		20%	CO1	C3-C4, C6, P7
				CO3	C2-C4, C6, A5
Total Marks			100%		

(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

REFERENCE SITE

GERM-352: Fundamentals of Research Methodology

COURSE INFORMATION

Course Code Course Title	: GERM-352 : Fundamentals of Research Methodology	Lecture Contact Hours Credit Hours	: 4.00 : 2.00

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 statement and research questions/objectives.	C2	-			Assignment/Quiz
CO2	Formulate and compose a research proposal considering research activities/design, background studies, and following standard guidelines.	C3	-			Report/Presentation/ Assignment/Quiz
CO3	Develop writing and presentation skill, and demonstrate ethical considerations in conducting research.	C3	-			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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the research fundamentals and formulate problem statement and research questions/objectives.	H											
CO2	Formulate and compose a Research proposal considering research activities, background studies, and following standard guidelines.		L									M	
CO3	Develop writing and presentation skill, and demonstrate ethical considerations in conducting research.								H	M			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Increase breadth & depth of knowledge through understanding the research fundamentals and formulating research objectives.
CO2-PO2	Low	Understand complex problems by doing background studies and following standard guidelines.
CO2-PO11	Medium	Understand level of management required for a Research proposal considering research activities.
CO3-PO7	High	Exercise ethical practice while conducting research and writing reports.
CO3-PO9	Medium	Recognize role in and diversity of a team by conducting research in a group.

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 Lec 2 Lec 3 Lec 4	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 5-8	Practice session on Foundations of Research	
3	Lec 9 Lec 10 Lec 11 Lec 12	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 13-16	Practice session on Problem Identification & Formulation	**Assignment 1** Assignment has to provide before, here students will submit report and give PPT
5	Lec 17 Lec 18 Lec 19 Lec 20	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 21-24	Practice session on Research Design	
7	Lec 25 Lec 26 Lec 27 Lec 28	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 29-32	Practice session on Data Analysis	**Continuous Assessment** (presentation/ quiz/other assignment)
9	Lec 33 Lec 34 Lec 35 Lec 36	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 37-40	Practice session on Research misconduct and Ethics	
11	Lec 41 Lec 42 Lec 43 Lec 44	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 45-48	Practice session on Use of tools / techniques for Research	
13	Lec 49-52	Review Session (Theory) – I /Final Presentation	
14	Lec 53-56	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO10	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-PO6	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-PO6	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-CO10	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	Class test-2
	Lec-22	Socialism: features and influence	
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 Participation	5%	CO2	C2
	Mid term	15%	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.

REFERENCE SITE

GESL-303: Environment, Sustainability and Law

COURSE INFORMATION

Course Code Course Title	: GEN-303 : Environment, Sustainability and Law	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 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	1	T, F
CO2	Analyse different environmental problems and apply technologies for sustainable environment.	C3-C4	1	2,4	7	T, MT, F, ASG
CO3	Understand the laws related to environment and sustainability and apply those law whenever required.	C2-C3	4, EP1	4	7	T, MT, F
CO4	Develop the communication skill by presenting topics on computer graphics.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Develop better understanding of environmental systems and impact of technology on the environment	H											
CO2	Analyse different environmental problems and apply technologies for sustainable environment.						H	H					
CO3	Understand the laws related to environment and sustainability and apply those law whenever required.						M		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-PO1	High	Understand various environmental issues and determine appropriate solutions applicable for solving the problems.
CO2-PO7	High	Develop eco-friendly technological solutions for enhancing environmental sustainability and explain the impacts of those on environment.
CO2-PO6	High	Develop strong sense of responsibility to protect the degrading environment and apply knowledge of green technologies for sustainable environment.
CO3-PO6	Medium	Apply the existing environmental laws where and whenever needed.
CO3-PO8	High	Develop the understanding of implementing the laws within family, society, country and globally.
CO4-PO10	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	 28
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 28 14 14
Formal Assessment Continuous Assessment Final Examination	 2 3
	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	Use and impact of IT within communities, IT and sustainability development	

	Lec 20		
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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C2
			CO2	C3-C4
			CO3	C2-C3
	Class Participation	5%	CO4	A2
	Mid term	15%	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

CSE-350: Industrial Training

COURSE INFORMATION

Course Code Course Title	: CSE-350 : Industrial Training	Lecture Contact Hours Credit Hours	: - : 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 report and presentation.

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 work responsibility and ethics in working environment	C2,P1		4	7	Pr, R
CO2	Communicate effectively within the working environment	P6		5	6	Pr
CO3	Apply theoretical and academic knowledge for solving the industrial problem.	C3, P4		3	5	ASG
CO4	Prepare training report and presentation	A4	1	1	3	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Develop work responsibility and ethics in working environment						H		H	M			
CO2	Communicate effectively within the working environment										H		
CO3	Apply theoretical and academic knowledge for solving the industrial problem												M
CO4	Preparation of training report and presentation					M							

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO6	High	Exposure in working environment enhances the level of knowledge and responsibility
CO1-PO8	High	Developing ethics in working environment helps uunderstanding and level of practice
CO1-PO9	Medium	Responsibility and ethics in working environment helps uunderstanding role in and diversity of team
CO2-PO10	High	Communicate effectively within the working environment according to type of activities performed
CO3-PO12	Medium	Apply theoretical and academic knowledge for solving the industrial problem enhances the depth of continuing learning

CO4-PO5	Medium	Preparation of training report and presentation increase the level of understanding of the appropriateness of the tool

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	24
Quiz/ test	-
Mid-Term	-
Final Examination	-
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	50%	CO1, CO2, CO3	C2,P1, P6, C3,
Report	50%	CO4	A4
Total Marks	100%		

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

REFERENCE BOOKS

As guided by the respective industry.

REFERENCE SITE

LEVEL-4 SPRING TERM

CSE-400: Final Year Research & Design Project

COURSE INFORMATION			
Course Code Course Title	: CSE 400 : Final Year Research & Design Project	Lecture Contact Hours Credit Hours	: 3.00 : 6.00

PRE-REQUISITE

Minimum earned credit: 108

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Culminating demonstration of skills and knowledge achieved to date to apply and solve real life problems solvable through computer technology.

OBJECTIVE

1. To apply technical knowledge and skills for further research and design of computer system at professional engineering scale.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Outcomes (Upon completion of the course, students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation	C2, A2	1		8	R
CO2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and standards	C3, A5	1,2	2	6	R
CO3	Identify sub-components of a complex problem, prepare timeline and appropriate budget using the project management skill	P3, A4	7	2	2	R
CO4	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements	C3	1, 2, 3		4	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

Previous course knowledge, Literature review, Self-learning, Interdisciplinary cooperation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify a real-life problem that can be translated to an engineering and/or computing solution through design, development and validation												H
CO2	Identify outcomes and functional requirements of the proposed solution considering software and/or hardware specification and		H	H									

	standards.												
CO3	Identify sub-components of a complex problem, prepare timeline and appropriate budget using the project management skill											H	
CO4	Analyze, design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements			H	H								

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO12	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of engineering problem and selecting appropriate solution
CO2 – PO3	High	Able to analyse and implement solution considering software and/or hardware specification and standards
CO3-PO11	High	Identify sub-components, prepare timeline and appropriate budget using the project management skill
CO4-PO4	High	Design, build, and evaluate engineering/computing system/subsystem with given specifications and requirements

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 84 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 - - -
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	89

TEACHING METHODOLOGY

Previous course knowledge, Literature review, Self learning, Interdisciplinary cooperation

COURSE SCHEDULE

Week	**Topics**	**Remarks**
1-2	Discussion with students, Topics Selection	6.00 hrs in every week
3-4	Analysis of the selected topics	
5-6	Review of Literature (I)	
7-8	Review of Literature (II)	
9-10	Work on methodology section	
11-12	Presentation on proposed research work	
13-14	Work on proposal: Introduction, Literature review and methodology	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Project Demo	30%	CO1, CO2, CO3, CO4	C2, C3, A2, A5

(40%)	Project Engagement	20%	CO3	P3, A4,P3,A4
Final Presentation (Project Presentation + Report)		50%	CO1, CO2, CO3, CO4	C2, C3, C4, A2, A5
Total Marks		100%		

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

REFERENCE BOOKS

REFERENCE SITE

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
Course Title: Microprocessors, 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 computer hardware components, its design and working principle and apply this knowledge in the real-world applications.

OBJECTIVE

1. To enable the students familiar to interface external components (peripherals, sensors, PPIs, PICs etc.) with computer systems.
2. To enhance the knowledge on basic working principle and different applications of basic microcomputer and microcontroller.
3. To enable the students capable of designing and constructing simple control system incorporating input/output to and from external devices.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Learning Outcome (Upon completion of the course, students will able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Classify, identify and analyse that how the interface different types of external components work and communicate (Peripherals, sensors, PPIs, PICs etc.) with computer system	C1-C3, P4	1		3	T, F
CO2	Apply and implement the external components in real life application and improve the results based on statistical analysis.	C3-C4, A2	3		5	Mid Term Exam,F
CO3	Analyze and evaluate abstract problems and apply hardware and software components to address the problem.	C5-C6, P5	7	2	2,6	Final Exam

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

COURSE CONTENT

Serial and parallel communication interface: I/O devices, Interfacing with different peripheral devices (Keyboard, Alphanumeric Display, LED), **Interfacing Microcomputers**: ports to high power devices, Interfacing to AC power devices, Interfacing microcomputer to motor, 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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Classify, identify and analyse that how the interface different types of external components work and communicate (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 problem.		H										

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO1	High	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 – PO3	High	To apply external components in real life application and improve the results based on statistical analysis one has to design the systems.
CO1-PO2	High	Analyze and evaluate abstract problems and apply hardware and software components to address the problem one need to analyse 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	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	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	Data Highways, Computer I/O Operations, Programmed I/O, Interrupts, Vectored Interrupt, Priority Interrupts using Priority Encoder ,Priority Interrupt using a Daisy Chain	
3	Lec 7 Lec 8 Lec 9	Block Data Transfer, DMA, Parallel Interface, SCSI, Serial InterfaceSynchronous and Asynchronous Transmission	
4	Lec 10 Lec 11 Lec 12	Interfacing to high power devices, Interface to AC power devices, interfacing to stepper motor	Class Test 2
5	Lec 13 Lec 14 Lec 15	Embedded Systems, Different types of Sensors and Transducers: Light Sensors, Temperature	
6	Lec 16 Lec 17 Lec 18	Different types of Sensors and Transducers: Force and Pressure Transducers, Flow Sensors	
7	Lec 19 Lec 20 Lec 21	Microcomputers based Scale, Microcomputers based industrial Process Control System , PID Controller	
8	Lec 22 Lec 23 Lec 24	Intel 8257 (Programmable DMA Controller)	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Disc and tape storage, Recording on a Magnetic surface, Magnetic Disc Formats, zoning, Interleaving, Magnetic recording Code, Recording Codes, Run-length limited (RLL),	
10	Lec 31 Lec 32 Lec 33	Disc formatting, Track seeking, Sector Location, Optical Storage, Forms of Optical Disc storage, Optical Reading Mechanism	
11	Lec 28 Lec 29 Lec 30	CD-ROM Optical Disks, WORM, Optical Positioning, Magneto Optical Disk, Performance Enhancers	Class Test 3
12	Lec 34 Lec 35 Lec 36	Printer Interface	
13	Lec 37 Lec 38 Lec 39	Interfacing microcomputer to motor	
14	Lec 40 Lec 41 Lec 42	Barcode Reader, Sound Card, USB Interface	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
			CO 3	C5-C6, P5
	Class Participation	5%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
	Mid term	15%	CO 2	C3-C4, A2

			CO 3	C5-C6, P5
Final Exam		60%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
			CO 3	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 Course Title	: CSE-406 : Computer Interfacing Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative wk : 0.75

PRE-REQUISITE

Course Code: Nil
Course Title: Nil

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, students will able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Develop systems' requirement specification from top-level customer requirements	C3, C6, P4	3	2	1	R, Pr
CO2	Analyse and compare design alternatives, at the system and subsystem levels, and use measures of performance or other criteria to rank alternatives.	C2-C4, P1	2	1	5	R, Pr
CO3	Plan and organize an engineering design project using tools such as Gantt charts to develop a work breakdown structure, develop a schedule including milestones, and estimate effort and costs incorporating the ethical, financial and environmental issues.	C3,C6, A4	2	1	7	R, Pr
CO4	Develop and design concept and elaborate it through to a detailed design by decomposing a system concept into component subsystems, identifying the subsystem requirements and	C3-C6, P4	1	3	6	R, Pr

	applicable standards, and defining interfaces between the subsystems.					
CO5	Develop full-functional prototype integrating Hardware and Software	C3, C6, P4	1	1	4	
CO6	Test to measure and evaluate the prototype to determine whether they meet performance and interface requirements considering ethical, financial and environmental issues and recommend changes.	C3, C6, P4	3	2	1	R, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, R-Report, Pr - Presentation, T-Test (Online)

COURSE CONTENT

Knowledge Acquisition: Information gathering techniques, Design of an information system; Hardware components, pin configurations of microcontroller, peripherals, Sensors, PPIs, PICs, Use of Arduino, Raspberry Pi.

Implementation: Concept development, prototype enhancement, complete implementation, unit testing and integration testing with verification, feedback and improvement, result analysis and performance evaluation, report writing, paper submission, presentation and final evaluation.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO 1	Develop systems' requirement specification from top level customer requirements	H	H				H						
CO 2	Analyse and compare design alternatives, at the system and subsystem levels, and use measures of performance or other criteria to rank alternatives.		H	H	H								
CO 3	Plan and organize an engineering design project using tools such as Gantt charts to develop a work breakdown structure, develop a schedule including milestones, and estimate effort and costs incorporating the ethical, financial and environmental issues.					H	H						
CO 4	Develop a design concept and elaborate it through to a detailed design by decomposing a system concept into component subsystems, identifying the subsystem requirements and applicable standards, and defining interfaces between the subsystems.			H	H						H		
CO 5	Build full-functional prototype integrating Hardware and Software					H				H		H	
CO 6	Test to measure and evaluate the prototype to determine whether they meet performance and interface requirements considering ethical, financial and environmental issues and recommend changes.				H			H				H	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1 – PO1	High	In order to solve complex engineering problems according to user requirements, knowledge of microcontroller, hardware and software usage is very important.
CO1 – PO2	High	To develop the system requirements of complex engineering problems according to user requirements one need to analyse the fundamental principles, typical characteristics and mechanisms of required microcontroller tools, hardware and software.
CO1-PO6	High	In order to serve the society as an engineer it's necessary to know the problem of the society from the customer requirements.
CO2- PO2	High	To analyse and compare the system alternative one need to analyse the fundamental principles, typical characteristics and mechanisms of required microcontroller tools, hardware and software.
CO2 –PO3	High	To compare the system alternatives one has to design the alternative systems with integration of hardware and software.
CO2 – PO4	High	To compare the system alternatives one has to investigate all pros and cons of those systems.
CO3 – PO5	High	To plan and organize an engineering design project one has to use modern tools such as: Gantt charts.
CO3 – PO6	High	To estimate the effort and costs of the project one needs to incorporate the society's ethical, financial and environmental issues.
CO4 – PO4	High	In order to identify the subsystem requirements and applicable standards one has to investigate the system and its outcome properly.
CO4-PO10	High	In order to identify the subsystem requirements and applicable standards, and define interfaces between the subsystems the group mates need to communicate among themselves and also with the customer.
CO5- PO5	High	In order to develop the prototype with the hardware and software on it needs to use modern tools like: Android studio, Bluetooth connection, Wi-Fi Communication, Sensors ect.
CO5 –PO9	High	In order to develop the whole workable prototype accumulating the engineering skill the one needs to perform their individual task and also maintain the team work.
CO5 – PO11	High	In order to develop the successful prototype its mandatory to manage the project and maintain the financial aspects.
CO6- PO4	High	In order to test to measure and evaluate the prototype to determine whether they meet performance and interface requirements, it's necessary to investigate the whole system properly.
CO6-PO7	High	In order to test the system one needs to find out the Sustainability of the system to the environment.
CO6- PO11	High	In order to pass the test, it's mandatory to meet the financial parameter.

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 (Lab) Project Preparation	- 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	47

TEACHING METHODOLOGY

Lectures, class performances, assignments, rubrics on problem analysis, literature review and designing prototype.

COURSE SCHEDULE

Week	Topic	Remarks
1	Project Proposal, Total Project Plan, Project Selection	3.00 hrs in alternative weeks
2	Requirement Analysis, Scheduling, Orientation with System Requirements	
3	Submission of System requirement report draft-01, Development of Prototype Subsystem	
4	Final System requirement report, Development of Prototype Subsystem	
5	Full Functional Prototype V.1 Submission	
6	Full Functional Prototype Final Submission	
7	Testing and testing results submission	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Report (45%)	Idea Submission	15%	CO 1-CO5	C2-C6, P1, P4, A4
	Project Plan/ Scheduling	10%	CO1-CO5	C2-C6, P1, P4, A4
	System requirement report	10%	CO1-CO5	C2-C6, P1, P4, A4
	Testing	10%	CO2, CO3, CO4	C2-C6, P1, P4, A4
Project (35%)	Functional Prototype	35%	CO1-CO5	C2-C6, P1, P4, A4
Final Presentation (10%)	Final Presentation	10%	CO1-CO5	C2-C6, P1, P4, A4
Class Observation		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 BY Ian Sommerville
5. Android Programming: The Big Nerd Ranch Guide (3rd Edition) (Big Nerd Ranch Guides) 3rd Edition Data and Computer Communication - William Stallings
6. 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)

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		3	T, F
CO2	Analyse the focused users and system requirements, and to design different kind of UIs and Interaction systems for building intuitive usable software solutions.	C4, C6	2		4, 5	T, MT
CO3	Apply (design) evaluation methods for assuring the enhanced usability including effectiveness, efficiency and satisfaction	C4	1		8	F
CO4	Develop the communication skill by presenting topics on HCI.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand and applying the fundamentals of HCI and Interaction design.	H											
CO2	Analyse the focused users and system requirements, and to design different kind of UIs and Interaction systems for building intuitive usable software solutions.		M	H									
CO3	Apply (design) evaluation methods for assuring the enhanced usability including effectiveness, efficiency and satisfaction				H								
CO4	Develop the communication skill by presenting topics on HCI.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	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-PO2, PO3	Medium, High	Understand how to profile the focused users and reveal the user requirements from usability perspective; as well as the interaction design techniques, rules, and principles for design the software systems including the ubiquitous computing, augmented realities and rich interfaces, by acquiring the knowledge regarding the ability to understand user-profile and design any usable information systems.
CO3-PO3	High	Conduct an in-depth usability/ design 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.
CO5-PO10	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	1	Introduction to HCI and Interaction design: HCI, Interaction design, The process of design	Class Test 1
	2	User focus, Scenarios, Navigation design	
	3	Screen design and layout, Iteration and prototyping.	
2	4	HCI in the software process: The software life cycle,	
	5	Usability engineering	
	6	Iterative design and prototyping, Design rationale.	
3	7	Design rules: Principles to support usability, Standards	
	8	Guidelines, Golden rules and heuristics	
	9	HCI patterns	
4	10	Evaluation techniques: What is evaluation? What, why, and when to evaluate, Goals of evaluation	Class Test 2
	11	Evaluation through expert analysis	
	12	Evaluation through user participation, Choosing an evaluation method.	
5	13	Evaluation paradigms and techniques,	
	14	The D E C I D E framework to guide evaluation.	
	15	The D E C I D E framework to guide evaluation. (Contd.)	
6	16	Observing users: Participant observation, ethnography, Data collection	
	17	Analyzing, interpreting and presenting data	
	18	Qualitative analysis, Feeding the findings back into design	
7	19	Asking users and experts: Interviews	Mid Term Exam
	20	Asking users and experts: Questionnaires,	
	21	Asking users and experts: Inspections	
8	22	Asking users and experts: Inspections (Contd.)	
	23	Asking users and experts: walkthroughs.	
	24	Asking users and experts: walkthroughs (Contd.)	
9	25	Universal design: Universal design principles	
	26	Multi-modal interaction	
	27	Designing for diversity	
10	28	Task analysis: Differences between task analysis and other techniques, Task decomposition	
	29	Knowledge-based techniques, Entity-relationship-based techniques	
	30	Sources of information and data collection, Uses of task analysis.	
11	31	Modeling rich interaction: Status-event analysis, Rich contexts	Class Test 3
	32	Low intention and sensor	
	33	Low intention and sensor (Contd.)	
12	34	Ubiquitous computing and augmented realities: Ubiquitous computing applications research.	
	35	virtual and augmented reality	
	36	Information and data visualization	
13	37	Hypertext, multimedia and the world wide web: Understanding hypertext,	
	38	Understanding hypertext(Contd.)	
	39	Finding things	
14	40	Web technology and issues	
	41	Static web content	
	42	Dynamic web content	

ASSESSMENT STRATEGY				
Components		**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (40%)	Test 1-2	20%	CO1	C1-C3
			CO2	C4, C6
	Class Participation	5%	CO4	A2
	Mid term	15%	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. ISBN 1-43
2. Alan Dix, Janet Finlay, Gregory Abowd, and Russell Beale (2003): Human–Computer Interaction. 3rd Edit Prentice Hall, 2003. http://hcibook.com/e3/ ISBN 0-13- 046109-1
3. Yvonne Rogers, Helen Sharp, Jenny Preece (2019): Interaction Design: Beyond Human Computer Interacti Edition), John Wiley & Sons.
4. Schneiderman B. and Plaisant, C.: Designing the User Interface (5th Edition), Addison-Wesley. Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser Research Methods in Human-Computer Interaction, Wiley, 2010. ISBN 0-470-72337-8, 978-0-470-72337-1

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

The Computer Security course is designed to provide a comprehensive understanding to the modern security system in computer science. The course begins with the history and development of security. Then it deals with various security models, cryptography, security attacks and the fundamental security objectives. This course also motivates to gather brief review of computer crimes and causes, internet, strategies, crime prevention, etc.

OBJECTIVE

1. To understand the development of security, traditional encryption, security attacks and the fundamental security objectives.
2. To determine and analyse the security objectives, attacks, and models, so is able to recognize the security requirements in real-life 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 the development of security, traditional encryption, security attacks and the fundamental security objectives	C2	1		3	T, F
CO2	Evaluate the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases	C5	2		5	M, T, F
CO3	Analyze the design and implementation issues of a real-life security solution.	C4	1		3	T, F
CO4	Able to develop the communication skill by presenting topics on operating systems	A2		1	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

Security : The Security Environment, Threats, Attackers; **Operating Systems Security** : Secure Systems, Trusted Computing Base; **Controlling Access to Resources**: Protection Domains, Access Control Lists, Capabilities; **Formal Models of Secure Systems:** Multilevel Security, Covert Channels; **Cryptography**: Overview, Symmetric cipher, Classical encryption technique, Block cipher and the data encryption standard (DES), Triple DES, Introduction to finite fields, Advanced Encryption Standard, Contemporary Symmetric Ciphers, confidentiality using symmetric encryption public, Key encryption and Hash functions, Public-key Cryptography, RSA algorithm, Key management, Diffie-Hellman key exchange, Other Public Key Cryptosystem, Message Authentication and Hash function, Hash Algorithm, Digital Signatures, Trusted Platform Modules; **Authentication**: Authentication using a physical object, Authentication using biometrics; **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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the development of security, traditional encryption, security attacks and the fundamental security objectives	H											
CO2	Determine the security objectives, attacks, and models, so is able to recognize the security requirements in real-life cases		H										
CO3	Analyze the design and implementation issues of a real-life security solution.			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-PO1	High	Increase breadth & depth of knowledge through understanding the development of security, traditional encryption, security attacks and the fundamental security objectives.
CO2-PO2	High	Understand and solve various complex problems by analysing security objectives, attacks, and models.
CO3-PO3	High	Understand and implement the design issues of real-life security solutions which have previously been identified and coded.
CO4-PO10	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	The Security Environment,	Class Test 1
	Lec 2	Threats, Attackers	
	Lec 3	Secure Systems, Trusted Computing Base	
2	Lec 4	Protection Domains, Access Control Lists	
	Lec 5	Capabilities	
	Lec 6	Multilevel Security, Covert Channels	
3	Lec 7	Introduction to cipher	
	Lec 8	Symmetric cipher	
	Lec 9	Classical encryption technique	
4	Lec 10	Block cipher	Class Test 2
	Lec 11	Data Encryption Standard (DES)	
	Lec 12	Triple DES	
5	Lec 13	Introduction to finite fields	
	Lec 14	Advanced Encryption Standard	
	Lec 15	Contemporary Symmetric Ciphers	
6	Lec 16	Symmetric Encryption	
	Lec 17	Key Encryption	
	Lec 18	Hash Functions	
7	Lec 19	Public-key Cryptography	
	Lec 20	RSA Algorithm	
	Lec 21	Key Management	
8	Lec 22	Diffie-Hellman key exchange	Mid Term Exam
	Lec 23	Public Key Cryptosystem	
	Lec 24	Message Authentication and Hash function	
9	Lec 25	Hash Algorithm	
	Lec 26	Digital Signatures	
	Lec 27	Trusted Platform Modules	

10	Lec 31 Lec 32 Lec 33	Authentication using a physical object Authentication using biometrics Buffer Overflow Attacks	
11	Lec 28 Lec 29 Lec 30	Format String Attacks Dangling Pointers, Null Pointer Dereference Attacks Integer Overflow Attacks, Command Injection Attacks Time of Check to Time of Use Attacks	Class Test 3
12	Lec 34 Lec 35 Lec 36	Logic Bombs, Back Doors, Login Spoofing Trojan Horses, Viruses, Worms, Spyware, Rootkits Firewalls, Antivirus and Anti-Antivirus Techniques	
13	Lec 37 Lec 38 Lec 39	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	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C2
			CO 2	C5
			CO 3	C4
	Class Participation	5%	CO4	A2
	Mid term	15%	CO 2	C5
Final Exam		60%	CO 1	C2
			CO 2	C5
			CO 3	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-464: Software Development Project-II

COURSE INFORMATION			
Course Code Course Title	: CSE-464 : Software Development Project-II	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: CSE-364
Course Title: Software Development Project-I

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

To be able to solve advanced level industry problems and develop real time Mobile application/smart application professionally.

OBJECTIVE

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

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 fundamentals of programming to design real time projects and to increase the depth of knowledge in programming.	C1,C2,A2		1.2	1	Q,Viva
CO2	Demonstrate the skill to develop and design a professional android app using Android software development tools.	C2-C4,C6.A3 P6,P7		1-4	5,6,7	PR,Q, Viva
CO3	Demonstrate the ability to deploy software to mobile devices and debug programs running on mobile devices.	C4-C5,P6		-	6,7	PR,Q,Viva

(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.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Learn the fundamentals of programming to design real time projects and to increase the depth of knowledge in programming.	H											
CO2	Demonstrate the skill to develop and design a professional android app using Android software development tools.			H					H		H		
CO3	Demonstrate the ability to deploy software to mobile devices and debug programs running on mobile devices.					H					H		H

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-PO1	High	Able to learn the basics of Android programming to develop simple Android applications that can run on Android phones and tablets.
CO2-PO3	High	Able to design and develop a complete real time project to solve the problems those were analysed before.
CO2-PO8	High	Must keep in mind the ethical values while designing an android app.
CO2-PO10	High	Able to do all the individual and group work properly by communicating with the respected persons.
CO3-PO5	High	Able to change the design of the app depending on the user requirement or to fix any bug by using appropriate of the tool
CO3-PO10	High	Able to develop communication skills through group work and viva.
CO3-PO12	High	Able to use the developed app in real life and use the knowledge later in their professional life.

(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	
Preparation of project	21
Assessment Preparations	04
Formal Assessment	
Continuous Assessment	06
Total	52

TEACHING METHODOLOGY

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

COURSE SCHEDULE

Lecture	Topics	Remarks
Lab 1	Course overview, Introduction to Design & Development of Mobile apps, Studying a Domain, Techniques for designing mobile apps, Paper and Interactive Prototyping, Usability Testing, Identifying Themes and Market Gaps	
Lab 2	Getting Started on Android OS, Android Installation, Introduction with UI, life cycle, simple components, xml, Toast, Components input controls and events	
Lab 3	Layout Design (Activity Changing, Layouts- Relative, Constrained, GridView, ListView, Adapter)	
Lab 4	Fragment, Frame, Navigation Drawer, Service	
Lab 5	Update 1	
Lab 6	Cloud Based MySQL Database - Firebase Authentication, Firebase Database	
Lab 7	Cloud Based MySQL Database - Firebase Storage.	
Lab 8	Update 2	
Lab 9	Sensors- Accelerometer, Proximity, Gyroscope & Guestures	
Lab 10	Android Gaming & Animation	
Lab 11	Google API- MAP & Play Store	

Lab 12	Debugging	
Lab 13	Qualitative Methods: Field and Diary Studies	
Lab 14	Analyzing Data: Case Study, Testing APP Performances	

ASSESSMENT STRATEGY

<table>
<tr><th colspan="4">Components</th><th rowspan="2">CO</th><th rowspan="2">Blooms Taxonomy</th></tr>
<tr><th colspan="3">Continuous Assessment (100%)</th><th>Grading</th></tr>
<tr><td rowspan="6">Continuous Assessment (100%) Total Marks</td><td colspan="2">Class Performance & Observation</td><td>10%</td><td>CO1</td><td>C1,C2, A2</td></tr>
<tr><td rowspan="4">Project</td><td>Project Proposal (10%)</td><td rowspan="4">70%</td><td>CO1</td><td>C1, C2,A2</td></tr>
<tr><td>Project update-1+2(20%)</td><td>CO2</td><td>C2-C4, C6,A3, P6-P7</td></tr>
<tr><td rowspan="2">Project Final Submission (40%)</td><td>CO2</td><td>C2-C4, C6,A3, P6-P7</td></tr>
<tr><td>CO3</td><td>C4-C5, P6</td></tr>
<tr><td colspan="2">Quiz</td><td>20%</td><td>CO1</td><td>C1,C2, A2</td></tr>
<tr><td colspan="3"></td><td></td><td colspan="2"></td></tr>
</table>

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

REFERENCE BOOKS

1. Fundamentals of Software Engineering: Designed to Provide an Insight into the Software Engineering Concepts By Amiya Kumar Rath and Hitesh MOHAPATRA

REFERENCE SITE

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 Course Title	: GEEM-433 : Engineering Ethics and Moral Philosophy	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 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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the theoretical aspects of ethics and moral philosophy in	M											

	professional fields.												
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 Lec 2	Introduction to Ethics Principles of Engineering Ethics	Class Test 1
2	Lec 3 Lec 4	Ethical expectation Employers and Employees Relationship Obligation of an Engineer to Clients	
3	Lec 5 Lec 6	Professional Organization: ACM Standards and Codes Institutionalization of Ethical Conduct	
4	Lec 7 Lec 8	NSPE codes IEEE codes of conduct	Class Test 2
5	Lec 9 Lec 10	Ethical Problem Solving Techniques	
6	Lec 11 Lec 12	Case study methodology, different case studies	
7	Lec 13 Lec 14	ICT Act Right To Information (RTI) Patents and Royalty	

8	Lec 15 Lec 16	Ethical Dilemmas Choices (Whistle Blowing)	Mid Term Exam
9	Lec 17 Lec 18	Ethical Challenges for CSE Engineers	
10	Lec 19 Lec 20	The Rights and Responsibilities of Engineers Safety, Risk and Liability	
11	Lec 21 Lec 22	Computer Crime Cyber Security Privacy	
12	Lec 23 Lec 24	Confidentiality Issue in CSE Legal Framework in CSE Copyright laws	
13	Lec 25 Lec 26	Introduction to Philosophy of Engineering Metaphysics	
14	Lec 27 Lec 28	Epistemology, Axiology and logic	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (40%)	Test 1-3		CO 1	C1-C2
	Class Participation	5%	CO 4	A2
	Mid term	15%	CO 2	C3
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-400: Final Year Research & Design Project

COURSE INFORMATION			
Course Code Course Title	: CSE-400 : Final Year Research & Design Project	Lecture Contact Hours Credit Hours	: 6.00 : 3.00

PRE-REQUISITE

Minimum earned credit: 108

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

RATIONALE

Culminating demonstration of skills and knowledge achieved to date to apply and solve real life problems solvable through computer technology.

OBJECTIVE

To apply technical knowledge and skills for further research and design of computer system at professional engineering scale.

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	Use modern analysis and design tools in the process of designing and validating of a system and subsystem			1	5	PR,Pr
CO2	Assess professional, ethical, and social impacts and responsibilities of the design project			2	6	R
CO3	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project			2	2	R
CO4	Function effectively in a multi-disciplinary team					Peer Evaluation, Journal
CO5	Present design project results through written technical documents and oral presentations					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

Previous course knowledge, Literature review, Self-learning, Interdisciplinary cooperation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (POs)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Use modern analysis and design tools in the process of designing and validating of a system and subsystem			H	H	H							
CO2	Assess professional, ethical, and social impacts and						H		H				

	responsibilities of the design project												
CO3	Identify and validate the impact of environmental considerations and the sustainability of a system/subsystem of a complete project											H	
CO4	Function effectively in a multi-disciplinary team									H			
CO5	Present design project results through written technical documents and oral presentations										H		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO3-5	High	Able to use modern tools in analysis and design
CO2 – PO2-3	High	Consider ethical, societal issues in design
CO3-PO11	High	Consider environmental impacts in design
CO4-PO3-4	High	Able to work in teams
CO5-PO11	High	Able to demonstrate communication skills through project presentation and reports

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	84
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	89

TEACHING METHODOLOGY

Previous course knowledge, Literature review, Self learning, Interdisciplinary cooperation

COURSE SCHEDULE

Week	**Topics**	**Remarks**
1-2	Relevant data collection and data analysis (I)	6.00 hrs in every week
3-4	Relevant data collection and data analysis (II)	
5-6	Relevant data collection and data analysis (III)	
7-8	Final update on proposed work (I)	
9-10	Final update on proposed work (II)	
11-12	Research proposal and report evaluation considering rubrics	
13-14	Proposal Defence (Oral)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Project Demo	30%	CO1, CO2, CO3, CO4	C2, C3, A2, A5

(40%)	Project Engagement	20%	CO3	P3, A4,P3,A4
Final Presentation (Project Presentation + Report)		50%	CO1, CO2, CO3, CO4	C2, C3, C4, A2, A5
Total Marks		100%		

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

REFERENCE BOOKS

REFERENCE SITE

CSE-401: Information System Design and Development

COURSE INFORMATION

Course Code Course Title	: CSE-401 : Information System Design and Development	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 Information System Design and Development course motivates to perceive information systems planning, analysis, design and implementation; project management, 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, 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		3	T, F
CO2	Apply the practical approaches of structured and cost-benefit analysis for developing information systems for industries/ business organizations.	C2, C3	1	4	5	T, MT
CO3	Analyse and organize a system using project management techniques and develop awareness regarding ethics and security of a system.	C4, C6	3	3	5	F

CO4	Develop the communication skill by presenting topics on information system design and development.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 techniques and develop awareness regarding ethics and security of a system.			H					L			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-PO1	High	Identify information types, system environment and roles of a system analyst through an in-depth knowledge of information system fundamentals.
CO2-PO3	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-PO3	High	Acquire knowledge for developing a system according to the user needs and specifications to understand the system organization techniques.
CO3-PO8	Low	Develop a secured and ethical system through the knowledge of system development ethics and security in engineering practice.

CO3-PO11	Medium	Develop a system to formally manage projects in different environments following different principles and knowledge of project management techniques.
CO4-PO10	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	1	System concepts	Class Test 1
	2	System concepts (Contd.)	
	3	System concepts (Contd.)	
2	4	Information systems environment	
	5	Information systems environment (Contd.)	
	6	Information systems environment (Contd.)	
3	7	The system development lifecycle	
	8	The system development lifecycle (Contd.)	
	9	The system development lifecycle (Contd.)	
4	10	The role of the system analyst	Class Test 2
	11	The role of the system analyst (Contd.)	
	12	The role of the system analyst (Contd.)	
5	13	Systems planning	
	14	Systems planning (Contd.)	
	15	Systems planning (Contd.)	
6	16	Initial investigation	
	17	Initial investigation (Contd.)	
	18	Initial investigation (Contd.)	
7	19	Information gathering	Mid Term Exam
	20	Information gathering (Contd.)	
	21	Information gathering (Contd.)	
8	22	The tools of structured analysis	
	23	The tools of structured analysis (Contd.)	
	24	The tools of structured analysis (Contd.)	
9	25	The tools of structured analysis (Contd.)	
	26	The tools of structured analysis (Contd.)	
	27	The tools of structured analysis (Contd.)	
10	28	Cost-benefit analysis	
	29	Cost-benefit analysis (Contd.)	
	30	Cost-benefit analysis (Contd.)	
11	31	Cost-benefit analysis (Contd.)	Class Test 3
	32	Cost-benefit analysis (Contd.)	
	33	Cost-benefit analysis (Contd.)	

12	34	Project management techniques	
	35	Project management techniques (Contd.)	
	36	Project management techniques (Contd.)	
13	37	System maintenance	
	38	System maintenance (Contd.)	
	39	System maintenance (Contd.)	
14	40	Security, disaster/recovery, and ethics in system development	
	41	Security, disaster/recovery, and ethics in system development (Contd.)	
	42	Security, disaster/recovery, and ethics in system development (Contd.)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C2, C3
	Class Participation	5%	CO4	A2
	Mid term	15%	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-403: Artificial Intelligence

COURSE INFORMATION

Course Code Course Title	: CSE-403 : Artificial Intelligence	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 intelligence is the beginning of revolution for rational behaviour 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 behaviour 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

No.	Course Learning Outcome (Upon completion of the course, the students will be able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Remembering and understanding the notions of rational behaviour, goals, subareas, achievements and difficulties of AI agents.	C1, C2	1		1	T
CO2	Able to apply problem solving methods (informed, uninformed, local search, adversarial search and CSP) of single or multi agents to solve real life problems.	C2, C6	3		5, 6	T, MT, F
CO3	Able to apply major concepts and approaches of knowledge representation, planning and learning for improving machine intelligence.	C6, P3	2, 7		5, 8	T, MT, F
CO4	Able to develop the communication skill by presenting topics on Artificial Intelligent.	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

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

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Remembering and understanding the notions of rational behaviour, goals, subareas, achievements and difficulties of AI agents.	H											
CO2	Able to apply problem solving methods (informed, uninformed, local search, adversarial search and CSP) of single or multi agents to solve real life problems.			H									
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.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING		
Mapping	Level	Justifications
CO1-PO1	High	As graduates will have to acquire knowledge on different types of agent architecture and working procedure.
CO2-PO3	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-PO3	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-PO10	Low	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 1 Lec 2, 3	Uninformed Search I Uninformed Search II	
3.	Lec 1 Lec 2, 3	Informed Search I Informed Search II	
4.	Lec 1 Lec 2, 3	Memory Bounded Search I Memory Bounded Search II	
5.	Lec 1 Lec 2, 3	Beyond Classical Search I Beyond Classical Search II	Class Test - 2
6.	Lec 1 Lec 2, 3	Adversarial Search I Adversarial Search II	
7.	Lec 1 Lec 2, 3	Constraint Satisfaction Problems I Constraint Satisfaction Problems II	
8.	Lec 1 Lec 2 Lec 3	Planning with State Space Search Planning with Partial Order Search Graph Search	
9.	Lec 1 Lec 2 Lec 3	Uncertainty and Probabilities Propositional Logic First Oder Logic	
10.	Lec 1-3	Second Oder Logic	Mid Term Exam

11.	Lec 1 Lec 2 Lec 3	Bayesian Rule Probabilistic reasoning Bayes Net	
12.	Lec 1 Lec 2,3	Naive Bayes Belief Networks Decision Networks	Class Test-3
13.	Lec 1 Lec 2,3	Perceptions Kernels and Clustering	
14.	Lec 1-3	Learning General Logical descriptions-Hypothesis. Introduction to Natural Language Processing.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C2, C6
			CO3	C6, P3
	Class Participation	5%	CO4	A2
	Mid term	15%	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 (4^{th} Edition) – Stuart Jonathan Russell, Peter Norvig; Prentice Hall (2020)
2. Artificial Intelligence: A New synthesis – Nils J. Nilsson; Routledge

REFERENCE SITE

CSE-404: Artificial Intelligence Sessional

COURSE INFORMATION

Course Code Course Title	: CSE-404 : Artificial Intelligence Sessional	Lecture Contact Hours Credit Hours	: 3.00 hr, in alternating week : 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

1. To have general understanding of major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.
2. To develop programming skills for AI applications and explore traditional AI techniques and

algorithms.

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	1, 2, 8	ASG, Q
CO2	Analysing and evaluating programming skills for AI applications.	C4, C5	2	5	4, 6	ASG ,Q
CO3	Applying traditional AI techniques and algorithms for solving problem.	C3	7	5	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; F – Final Exam, MT- Mid Term Exam)

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Applying, evaluating and valuing major concepts and approaches in knowledge representation, planning, learning, robotics and other AI areas.				H								
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	High	Graduates will conduct investigations on different approaches of knowledge representation, planning and learning for different agent to provide valid conclusions.
CO2-PO5	High	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	High	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 Student-Centred Learning	 21 -
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	Lab	Topics	Remarks
1	Lab-1,2	Orientation with AI practical areas	3:00 hrs in alternate week
3	Lab-3,4	State Mapping Problem	
5	Lab-5,6	Informed Search Algorithm implementation	
7	Lab-7,8	Local Search implementation	
9	Lab-9,10	Adversarial Search implementation	
11	Lab-11,12	Constraint Satisfaction Problem	
13	Lab- 13,14	Learning Algorithm to solve problem	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (80%)	Task 1-3	30	CO3	C3
			CO3	C3
	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
3. Choco Solver Documentation - Charles Prud'homme, Jean-Guillaume Fages, Xavier Lorca

REFERENCE SITE

CSE-413: Computer Graphics

COURSE INFORMATION

Course Code Course Title	: CSE-413 : Computer Graphics	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 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		1,3	T, MT, F
CO2	Interpret the mathematical foundation of the concepts of computer graphics and apply those concepts in different geometric objects.	C3, C5	1		1, 2	T, MT, F
CO3	Analyse different algorithms and techniques of computer graphics and apply those in graphical model.	C3, C4	2	5	5	F
CO4	Develop the communication skill by presenting topics on computer graphics.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	Analyse different algorithms and techniques of computer graphics and apply those in graphical model.			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-PO1	High	Develop breadth & depth of knowledge by understanding the basic concepts of computer graphics like transformation of objects, modelling, projection, rendering, shading etc.
CO2-PO2	High	Analyse and interpret different mathematical concepts to formulate different methods and techniques of computer graphics.
CO3-PO3	High	Analyse different computer graphics algorithms to developing a solution of various engineering problems and apply in a correct way.
CO4-PO10	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: 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	**Projection**: Parallel projection, camera positioning;	

	Lec 27		
10	Lec 31 Lec 32 Lec 33	**Hidden Surface Removal:** Back face culling, Painters algorithm	
11	Lec 28 Lec 29 Lec 30	**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	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1, C2
			CO2	C3, C5
			CO3	C3, C4
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C3, C5
			CO3	C3, C4
Final Exam		60%	CO1	C1, C2
			CO2	C3, C5
			CO3	C3, C4
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 Course Title	: CSE-414 : Computer Graphics 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 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 project 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 able to)	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Apply graphics programming techniques to solve graphics problem related to modelling transformation, rendering, texture mapping etc.	C3	1,2	-	5	Q
CO2	Develop 2D and 3D graphical geometric objects.	C3, C6, A5	1,3	1,2	5,7	Q, ASG
CO3	Create animation or real time applications using open-source software.	C2, C6, P6	1,5	3	5,6	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Apply graphics programming techniques to solve graphics problem related to modelling transformation, rendering, texture mapping etc.			H									
CO2	Develop 2D and 3D graphical geometric objects.			H						H			
CO3	Create animation or real time applications using open source software.					H				H			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO2	Medium	Apply the knowledge acquired in the theory class by analysing the context of the problems and also provide solutions of graphics problem.
CO2-PO3	High	Develop 2D and 3D geometric object in OPENGL platform using the computer graphics concept.
CO3-PO5	High	Different modern IT tools will be used to create animation and games
CO2-PO9, CO3-PO9	High	Group of students will be worked in a particular project that will in turn help them to learn working in a group.

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 to 2D Graphics and OpenGL. Drawing 2D geometric object	3.00 hrs in alternate week
3	Lab-3,4	Simple 2D animation and modelling transformation using OpenGL	
5	Lab-5,6	Drawing 3D geometric object and 3D animation in OpenGL	
7	Lab-7,8	Introduction to blender/ unity	
9	Lab-9,10	3D modelling and Lighting in blender/unity	
11	Lab-11,12	Texturing and coloring, Rigging	
13	Lab-13,14	Rendering, animation	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (80%)	2D Assignment	25%	CO1	C3
			CO2	C3, C6, A5
	3D Assignment	25%	CO2	C3, C6, A5
	Project	30%	CO3	C2, C6, P6
			CO3	C2, C6, P6
Final Quiz		20%	CO1	C3
			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 (2nd) - Zhigang Xiang, Roy A. Plastock 2. OpenGL programming guide (The official guide to learning OpenGL, 8th)- Dave Shreiner, Graham Sellers, John Kessenich, Bill Licea-Kane
REFERENCE SITE

CSE-4XO: Technical Elective-II

COURSE INFORMATION			
Course Code Course Title	: CSE-4XO : Technical Elective-II	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

**Details of all Technical elective subjects are given later.*

CSE-4XE: Technical Elective-II Sessional

COURSE INFORMATION			
Course Code Course Title	: CSE-4XE : Technical Elective -II Sessional	Lecture Contact Hours Credit Hours	: 3.00 hrs in alternative week : 0.75

**Details of all Technical elective subjects are given later.*

GEPM-463: Project Management and Finance

COURSE INFORMATION			
Course Code Course Title	: GEPM-463 : Project Management and Finance	Lecture Contact Hours Credit Hours	: 2.00 : 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			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	3		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	2	2	7	T, F
CO5	Develop communication skills by presenting topics on project management and finance.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Demonstrate different management and control frameworks and know their impact on the project management discipline, we need knowledge of science and engineering.
CO2-PO2	High	Design and conduct experiments to identify, analysis, and articulate the importance of team building, project risk, and financial management.
CO3-PO5	High	Use the techniques, skills, and modern engineering tools in order to use management software to help plan and manage information technology projects.
CO4-PO11	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-PO10	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 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	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**	**Blooms Taxonomy**
Continuous Assessment (40%)	Test 1-2		CO1	C1-C3
			CO4	C3
	Class Participation	5%	CO5	A2
	Mid term	15%	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-407: Applied Statistics and Queuing Theory

COURSE INFORMATION			
Course Code Course Title	: CSE-407 : Applied Statistics and Queuing 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 provides the deep idea of working with data sets and impacts of data set as well as application of queuing models in computer science context

OBJECTIVE

1. To discuss the theories of applied statistics
2. To select the practical applications in the field of Information Technology and explain the real-life application of statistics.

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, analyze and evaluate the theories of applied statistics	C2,C3 C6, A3	1		3	T, F
CO2	Apply and implement the practical applications in the field of Information Technology.	C3,C4,C5, P2	3	2	1,2	MT, F
CO3	Analyze the real-life applications of statistics.	C4, P4	3	3	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: Frequency distribution, Mean, median, Mode and other measure of central tendency standard deviation and other measure of dispersion, Moments, Skewness and kurtosis, Elementary probability theory, Characteristics of distributions, elementary sampling theory, Estimation, Hypothesis testing and regression analysis; **Probability:** Probability distribution and expectations, discontinuous probability distribution, e.g. binomial, position and negative binomial. Continuous probability distributions, e.g. normal and exponential; **Queuing Theory:** Stochastic processes, Discrete time Markov chain and continuous time Markov Chain, birth-death process in queuing; **Queuing models:** M/M/1, M/M/C, M/G/1, M/D/1, G/M/1 solution of network of queue-closed queuing models and approximate models, Application of queuing models in Computer Science.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Classify, analyze and evaluate the theories of applied statistics	H											
CO2	Apply and implement the practical applications in the field of Information Technology.		H										
CO3	Analyze the real-life applications of statistics.						H						

(H – High, M- Medium, L-low)

Justification for CO-PO mapping:		
Mapping	Level	Justifications
CO1-PO1	High	In order to understand application of the theories of applied statistics , one need to have the basic knowledge of theories of applied statistics
CO2-PO2	High	In order to Select the practical applications in the field of Information Technology one has to analyze the basic principle, theories and fundamentals of the applied statistics
CO3-PO6	High	To be able to apply the basic techniques of statistics in real life.

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, Frequency distribution	Class Test 1
2	Lec 4 Lec 5 Lec 6	Central Tendency, Mean, median, Mode	
3	Lec 7 Lec 8 Lec 9	Standard deviation and other measure of dispersion	
4	Lec 10 Lec 11 Lec 12	Moments, Skewness and kurtosis	Class Test 2
5	Lec 13 Lec 14 Lec 15	Elementary probability theory, Characteristics of distributions	
6	Lec 16 Lec 17 Lec 18	Elementary sampling theory, Estimation	
7	Lec 19 Lec 20 Lec 21	Hypothesis testing and regression analysis	
8	Lec 22 Lec 23 Lec 24	Probability distribution, Expectations	Mid Term Exam
9	Lec 25 Lec 26 Lec 27	Discontinuous probability distribution, Binomial distribution, Position and negative binomial distribution	
10	Lec 31 Lec 32	Continuous probability distributions, Normal Distribution, Exponential Distribution	

	Lec 33		
11	Lec 28 Lec 29 Lec 30	Queuing Theory: Stochastic processes, Discrete time Markov chain	Class Test 3
12	Lec 34 Lec 35 Lec 36	Continuous time Markov Chain, Birth-death process in queuing	
13	Lec 37 Lec 38 Lec 39	Queuing models, M/M/1.M/M/C.M/G/1.M/D/1, G/M/1 Queue-closed queuing models	
14	Lec 40 Lec 41 Lec 42	Approximate models, Application of queuing models	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
			CO 3	C5-C6, P5
	Class Participation	5%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
	Mid term	15%	CO 2	C3-C4, A2
			CO 3	C5-C6, P5
Final Exam		60%	CO 1	C1-C3, P4
			CO 2	C3-C4, A2
			CO 3	C5-C6, P5
Total Marks		100%		

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

REFERENCE BOOKS

1. Applied Statistics - Rebecca (Becky) M. (Margaret) Warner
2. Applied Statistics for Engineers and Scientists - Jay L. Devore and Nicholas R. Famum
3. An Introduction to Queuing Theory - U. Narayan Bhat
4. Probability, Markov Chains, Queues, and Simulation: The Mathematical Basis of Performance Modeling –William J. Stewart

REFERENCE SITE

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	T, ASG, Viva
CO2	Develop decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies	C2,C3	1		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		1-3	Mid Term, F
CO4	Develop the communication skills by presenting different topics on blockchain	A2		1		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	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 Lec 9	Byzantine Models of fault tolerance	
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	Bitcoin blockchain, the challenges, and solutions,	

	Lec 17 Lec 18	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	15%	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. 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	-	1	1	T
CO2	Determine the most suitable algorithm for any given task and then apply it to the problem.	C2-C4	2,3	5	2	MT, F
CO3	Demonstrate adequate comprehension of the theory of intractability and prove when certain kinds of problems are intractable.	C4, C6	1,4	2	3-5	F
CO4	Develop the communication skill by presenting topics on advanced algorithms.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Select and explain a variety of algorithms with practical applications and the resource requirements of each.		H								M		

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-PO2	High	Complexity of analysis will be required to find suitable algorithm and resource
CO1-PO10	Medium	In order to give presentation on selective topics, communication skills will be needed
CO2-PO4	High	Optimized algorithm can be selected by breadth & depth of investigation and experimentation
CO3-PO1	High	To prove the theory with proper logic, engineering knowledge is required
CO4-PO10	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 Advanced Algorithms Applications of Advanced Algorithms Fundamental Algorithms vs Advanced Algorithms	Class Test 1
2	Lec 4 Lec 5 Lec 6	Randomized Algorithms Las Vegas Algorithm Las Vegas Algorithm (Contd.)	
3	Lec 7 Lec 8 Lec 9	Monte Carlo Algorithm Monte Carlo Algorithm (Contd.) Randomized Data Structures	
4	Lec 10 Lec 11 Lec 12	Skip Lists Amortized Analysis Amortized Analysis Methods	Class Test 2

5	Lec 13 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	15%	CO2	C2-C4
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-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, 2	T, F
CO2	Explain and discuss mathematical proofs, including an appreciation of why this is important.	C2, C6	1	3	3, 4, 8	T, F
CO3	Formulate algorithms to solve problems with graph theories	C3	1	3,5	5	Mid, F
CO4	Develop the communication skill by presenting topics on operating systems.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Recognize the standard uses of graphs and the fundamental theory about graphs with a sense of some of its modern applications
CO2-PO4	High	Understand mathematical proofs and apply them in real research problems.
CO3-PO3	High	Develop algorithms to solve problems with graph theories
CO4-PO10	Medium	Develop communication skills through participating in quiz, presentation etc.

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, 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	Graceful labelling Matching and covering	

	Lec 29 Lec 30		
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	15%	CO2	C2, C6
			CO3	C3
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 (4th) - Douglas B West
2. Introduction to Graph Theory (5th) - Robin J. Wilson, Pearson Education Asia

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	1		4, 5	T, MT, F
CO2	Analyse reliability of different types of systems.	C4	2		4, 5	T, MT, F
CO3	Recognize defect avoidance and circumvention.	C5	2		4, 5	T, MT, F
CO4	Identify methodologies of hardening systems.	C3	2		4,5	T, MT, F
CO5	Develop the communication skill by presenting topics on Fault Tolerance.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO2	High	In order to explain different fault tolerant system, one must have to reach substantiated conclusions using knowledge of engineering sciences.
CO2-PO2	High	By analysing reliability of system, graduates will be more capable of analysing complex engineering problems.
CO3-PO2	High	To recognize defect of system, graduates will have to research on the system to formulate it and make conclusion.
CO4-PO2	High	In order to identify methodologies to harden a system, one must have to identify, formulate, research to get conclusion.
CO5-PO10	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	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 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	Performance Monitoring	

	Lec 20 Lec 21	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 Lec 42	Yields Enhancement Yields Enhancement (Contd.) 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	15%	CO1-CO4	C2, C3, C4, C5
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-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 (Upon completion of the course, the students will be able to)	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	-	1	T, F
CO2	Analyse different techniques and problems for multimedia document.	C2, C4	1,2	-	2,3	T, F, MT
CO3	Discover and apply the knowledge acquired in developing multimedia applications – audio and video conferencing, video on demand, and voice over IP.	C3-C5	1,4	-	5	MT, F, ASG
CO4	Develop the communication skill by presenting topics on computer graphics.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Develop a strong knowledge on multimedia theory and technology by understanding the basic concepts related to it.
CO2-PO2	High	Analyse different techniques to apply in various engineering problems.
CO3-PO3	High	Develop multimedia applications by analysing different requirements and techniques.
CO4-PO10	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	Disk placement and scheduling	

	Lec 17 Lec 18		
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	15%	CO2	C2, C4
			CO3	C3-C5
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-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		3	T, F
CO2	Evaluate the basic objectives and applications of image processing	C5	2		5	T, M, F
CO3	Analyze image sampling and quantization requirements and implications	C4	1		3	T, F, PR
CO4	Able to develop the communication skill by presenting topics on operating systems	A2		1	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 – P01	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 – PO2	High	Understand and solve various complex problems by analysing the basic elements and applications of image processing.
CO3 – PO3	High	Understand and implement the design issues required to develop and analyse image sampling and quantization requirements and implications.
CO4–PO10	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	Sub-Band Decomposition	

	Lec 18		
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
Continuous Assessment (40%)	Test 1-3	20%	CO1	C2
			CO2	C5
			CO3	C4
	Class Participation	5%	CO4	A2
	Mid term	15%	CO2	C5
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-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		1	T, F
CO2	Identify domain objects, their properties, and relationships among them.	C1, C2, C4	1		1	MT, F
CO3	Model/ represent domain constraints on the objects and (or) on their relationships.	C6	3	3	3	T, F
CO4	Develop design solutions for problems on various O-O concepts.	C3, C6	3	3	6	T, F
CO5	Develop the communication skill by presenting topics on object oriented software engineering.	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

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 addresses; **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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Understand where to appropriately apply different concepts basing on different context through a strong level of knowledge on various O-O concepts.
CO2-PO2	High	Design and conduct experiments by identifying relevant data objects of different domains, their attributes and different associations among them.
CO3-PO2	High	Derive a model or representation for a solution by specifying and interpreting certain constraints on data objects and their relationships.
CO4-PO3	High	Design and develop different solutions basing on the desired requirements through a detailed knowledge on various O-O concepts and their applicability.
CO5-PO10	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	1	Object-oriented approach	Class Test 1
	2	Object-oriented approach (Contd.)	
	3	Object-oriented approach (Contd.)	
2	4	Basic (procedural) elements of language	
	5	Basic (procedural) elements of language (Contd.)	
	6	Basic (procedural) elements of language (Contd.)	
3	7	Eiffel program	
	8	Instruction set	
	9	Entities (variables) and routines	
4	10	Concepts underlying the O-O approach	Class Test 2
	11	Modularity	
	12	Modularity (Contd.)	
5	13	Inheritance	

	14	Dynamic binding	
	15	Management information-system domain	
6	16	Environment matters: system configuration	
	17	Environment matters: system configuration (Contd.)	
	18	Environment matters: system configuration (Contd.)	
7	19	Interfacing with external software	Mid Term Exam
	20	Garbage collection	
	21	Garbage collection (Contd.)	
8	22	Advanced issues involving exception handling	
	23	Advanced issues involving exception handling (Contd.)	
	24	Advanced issues involving exception handling (Contd.)	
9	25	Repeated inheritance	
	26	Typing problems	
	27	Typing problems (Contd.)	
10	28	Parallelism	
	29	O-O software engineering process	
	30	O-O software engineering process (Contd.)	
11	31	OOAD to a maintainable Addresses verification	Class Test 3
	32	OOAD to a maintainable Addresses verification (Contd.)	
	33	OOAD to a maintainable Addresses verification (Contd.)	
12	34	OOAD to Address validation (V&V)	
	35	Issues of Eiffel software systems	
	36	Issues of Eiffel software systems (Contd.)	
13	37	Building reusable libraries	
	38	Building reusable libraries (Contd.)	
	39	Building reusable libraries (Contd.)	
14	40	The building of a parallel linear algebra library (Paladin)	
	41	The building of a parallel linear algebra library (Paladin) (Contd.)	
	42	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	15%	CO2	C1, C2, C4
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-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	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	3	1	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		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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Apply engineering knowledge to develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO2-PO2	High	Explore the functional components of neural network classifiers or controllers we need to analyze, design and conduct experiments.
CO3-PO4	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-PO10	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	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	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	15%	CO2	C3, C4

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-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		1	T
CO2	Apply the concepts to the example systems and algorithms	C3	2		4	MT
CO3	Adapt and design algorithms for execution in parallel and distributed settings	C2,C3,C5	3		5	T,F
CO4	Analyse the algorithms for correctness, reliability, security and performance	C4	3		2	F
CO5	Be able to develop communication skill by presenting topics on distributed algorithms.	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
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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Increase the breadth and depth of knowledge by understanding the fundamental concepts in the area of message passing and shared memory concurrency
CO2-PO1	High	Improve the breadth and depth of knowledge by applying the concepts to the example systems and algorithms
CO3-PO3	Medium	Adapt and design algorithms for execution in parallel and distributed settings in which solutions have previously been identified and coded
CO4-PO2	High	Improving the skill of problem analysis by analysing the algorithms for correctness, reliability, security and performance
CO5-PO10	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	15%	CO2	C3
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-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	-	3	T, F
CO2	Percept methods in sequence bioinformatics such as sequence alignment, phylogenetic analysis and pattern recognition.	C4, P1	3	-	2	T, Mid Term Exam, F
CO3	Analyze and compile results of bioinformatic analyses, such as protein structure prediction, molecular biology etc.	C4, C5	2,3	-	4	T, Mid Term Exam, F
CO4	Solve given biological problems by using appropriate bioinformatic methods and databases.	P1, C6	2, 3	1, 2	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO4	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-PO1	High	In-depth engineering knowledge can be perceived through understanding different bioinformatics algorithm, e.g., sequence alignment, phylogenetic analysis and pattern recognition.
CO3-PO3	High	Complexity of an engineering problem can be realized by inspecting results of bioinformatics algorithms.
CO4-PO3	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 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 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	15%	CO2	C4, P1
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-439: Robotics

COURSE INFORMATION

Course Code	: CSE-439	Lecture Contact Hours	: 3.00
Course Title	: Robotics	Credit Hours	: 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	1	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	2		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	3, 5, EP2	3, 5	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 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									

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	High	Understand the breadth and depth of different concept development and key components of robotics technologies.
CO2-PO2	High	Analyse complex robotics problems and understand the ways to solve them.
CO3-PO3	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	Introduction to Robotics	Class Test-1
	Lec 2	Applications of Robotics	
	Lec 3	Evolution of Robotics	
2	Lec 4	Overview of Robot Mechanisms	
	Lec 5	Overview of Robot Dynamics	
	Lec 6	Overview of Robot Intelligent Controls	
3	Lec 7	Spatial Descriptions	
	Lec 8	Transformations	
	Lec 9	Introduction to Kinematics	
4	Lec 10	Planar Kinematics	Class Test-2
	Lec 11	Spatial Kinematics	
	Lec 12	Motion Planning	
5	Lec 13	Mechanism Design for Manipulators	
	Lec 14	Mechanism Design for Mobile Robots	
	Lec 15	Mechanism Design for Mobile Robots (Contd.)	
6	Lec 16	Manipulator Kinematics	
	Lec 17	Inverse Manipulator Kinematics	
	Lec 18	Introduction to Dynamics	
7	Lec 19	Manipulator Dynamics	Mid Term Exam
	Lec 20	Trajectory Generation	
	Lec 21	Multi-rigid body Dynamics	
8	Lec 22	Linear Control of manipulators	
	Lec 23	Non-Linear Control Manipulators	
	Lec 24	Force Control of Manipulators	
9	Lec 25	3D Graphic Simulation	
	Lec 26	3D Graphic Simulation (Contd.)	
	Lec 27	3D Graphic Simulation (Contd.)	
10	Lec 28	Control Design	
	Lec 29	Actuators	
	Lec 30	Sensors	
11	Lec 31	Task Modelling, Face Control and Haptics	Class Test-4
	Lec 32	Human-Machine Interface	
	Lec 33	Embedded Software Mechanical Design	
12	Lec 34	Jacobean Kinematics	
	Lec 35	Inverse Kinematics	
	Lec 36	Redundant and Parallel Robots	
13	Lec 37	Micro Robotics	
	Lec 38	Nano-Robotics	
	Lec 39	Mobile Robots	
14	Lec 40	Human-robot interaction	
	Lec 41	Multiagents	
	Lec 42	Fault Diagnosis	

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	15%	CO2	C4, P6
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. 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-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	1	1	T, F
CO2	Learn to design, implement, and manage telecommunications systems using voice and	C6	2	2	1, 3	Q,MT,F

	data.					
CO3	Model and simulate telecommunications systems and networks in order to identify and solve these problems	P6	3	3	5	ASG
CO4	Acquire the knowledge and expertise in the field of telecommunication hardware	C3, A2	2	1	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Demonstrate theoretical and technical knowledge of telecommunications systems associated with LANs, MANs, and WANs.	H											
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	M								
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-PO2	High	Understanding the theoretical and technical will highly increase the breadth and depth of knowledge
CO2-PO3	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-PO3	High	Identifying and solving the problems of telecommunications systems and networks enhance breadth & uniqueness of engineering problems
CO3-PO4	Medium	Application of standard distribution will help to understand the breadth and uniqueness of engineering problem
CO4-PO5	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	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision	21
Assignment Preparations	21
Formal Assessment	
Continuous Assessment	2
Quiz/ test	3
Mid-Term	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: 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	Traffic Characterization Traffic Analysis	

	Lec 30	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	15%	CO 2	C2
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	1	2, 3	T, F, Pr
CO2	Understand and analyze models of moderately sized CMOS circuits to implement specified digital functions.	C1-C4, C6, A2, P1-P2	1, 2	2	2-4	MT, 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	1	1	3, 4	MT,T, 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	3, 7	3, 5	4, 5	MT, 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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	H		M								
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				M	L	L					
CO4	Design MOS circuits to achieve various basic to moderately complex digital functions using VLSI design rules and geometric or stick diagrams.		H	H							L	L	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	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.
CO2-PO1	High	Understanding the models and internal workings of basic CMOS circuits will help in acquiring fundamental knowledge on VLSI circuits.
CO2-PO2	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.
CO2-PO4	Medium	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-PO1	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.
CO2-PO5	Medium	The students will also learn about the modern fabrication process and the various tool and techniques used in modern VLSI fabrication.
CO2-PO6	Low	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.
CO2-PO7	Low	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.
CO4-PO2	High	The VLSI design process requires the analytical ability of students in coming up with logical designs for the various VLSI designs.
CO4-PO3	High	The students would need to apply their knowledge of basic CMOS circuits and gates to design various basic to moderately complex VLSI systems.
CO4-PO10	Low	The students will also develop the skill to work as an individual in engineering design problems such the VLSI system design.

CO4-PO11	Low	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	15%	CO2-CO4	C1-C6, A1-A3, P1-P2
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 Course Title	: CSE-412 : VLSI Design 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 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 this 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	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	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		3	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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				H							
CO2	Analyze a given digital function or a given circuit problem to implement and evaluate a VLSI system or CMOS circuit.		H	H				M					
CO3	Design and implement the solutions developed by the students for particular problems using ICs and simulator software.			H		H					H	M	

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1-PO1	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.
CO1-PO5	High	Various simulator software will help students to use modern tools, techniques and software in designing and evaluating various CMOS circuits and systems.
CO2-PO2	High	Students will have to analyze the given digital function and design a solution for that using CMOS circuits.
CO2-PO3	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.
CO2-PO7	Medium	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-PO3	High	While implementing their solutions in simulators, students will get a better understanding of their VLSI system design and it's various considerations.
CO3-PO5	High	Students will be using various latest simulator software for implementing their designs and to test the characteristics of basic designs of various CMOS circuits. .
CO3-PO10	High	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.
CO3-PO11	Medium	Through the overall design process, students will also get an overall understanding of the VLSI system and it's 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-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	Introduction to PSpice, Design and implement some basic electrical circuits with PSpice	3:00 hrs in alternate week
3	Lab-3,4	Design and implement logic gates (inverter, AND, OR, NAND, NOR) with PSpice	
5	Lab-5,6	Design and implement logic gates (AND, OR, NAND, NOR) and their I/O graphs with PSpice and DSCH and compare the results	
7	Lab-7,8	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	
9	Lab-9,10	Design and implement some basic electrical circuits with Microwind	
11	Lab-11,12	Design and implement inverter, AND, OR, NAND, NOR with Microwind	
13	Lab- 13,14	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
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 learning parameters to achieve maximum performance.
3. To familiarize with a broad cross-section of models and algorithms for machine learning, and prepare for research or industry application of machine learning 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	Develop an appreciation for what is involved in learning models from data.	C2, P1	1		1, 3	T
CO2	Understand a wide variety of learning algorithms.	C1 - C2, A1	1		2	F, T
CO3	Understand how to evaluate models generated from data and Enhance the learning parameters to achieve maximum performance.	C4 – C6 P6, P5, A4	1, 3		6	MT
CO4	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.	C1-C6, A2, P3 - P5	1, 3, 7, EP1, EP2	5	1, 6	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Develop an appreciation for what is involved in learning models from data.	H											
CO2	Understand a wide variety of learning algorithms.	M											
CO3	Understand how to evaluate models generated from data and Enhance the learning parameters to achieve maximum performance.		H	M									
CO4	Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.												M

(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-PO1	Medium	Explore the branches of learning algorithms
CO3-PO2, PO3	High, Medium	Design and solve unique engineering problems by enhancing the learning parameters to achieve maximum performance and better understanding of the subject.
CO4-PO12	Medium	Apply the learning techniques and algorithms in real-world problems having a life-long impact.

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 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	Parameter Estimation	

	Lec 38		
	Lec 39		
14	Lec 40	Computational Learning Theory	
	Lec 41		
	Lec 42		

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	15%	CO3	C4, P6
Final Exam		60%	CO1, CO3	C1-C4, 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 (2nd 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	1	6	T, Q
CO2	Evaluate the strengths and weaknesses of many popular machine learning approaches.	C3, C6, A4, A5, P6	2	2	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	6	4	2	R, Q, Pr
CO4	Design and implement various machine learning algorithms in a range of real-world applications.	P3, A4, C3, C4, C6	3, 7, EP2	3	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO2	High	Able to understand the complexity in analysis of data. Model selection, challenges and fundamental issues of machine learning.
CO2-PO5	High	Able to identify the appropriate modern tools or learning algorithms and evaluate their strengths and weaknesses.

CO3-PO4	Medium	Able to appreciate the mathematical relationships and in depth investigation and experimentation of the paradigms of supervised and unsupervised learning.
CO4-PO3	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 Assessmen	Test and Assignment	40%	CO1	C2, P6
			CO2	C3, A5

t (40%)	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. 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 Course Title	: CSE-443 : Pattern Recognition	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 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		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		1, 3	MT
CO3	Solve problems in regression and classification.	P3	7	3	6	F
CO4	Develop communication skill by presenting topics on pattern recognition	A2		1	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 – PO1	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of pattern recognition algorithms
CO2 – PO2	High	Able to understand and analyse of pattern recognition algorithms
CO3 – PO3	High	Able to implement of pattern recognition algorithms
CO4-PO10	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	15%	CO 3	C4
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	5	T, Q
CO3	Implement solution to problems in classification and regression through group project work	C3,A5		2	6	ASG, Q
CO4	Develop oral and written communication skills to deliver solution on pattern recognition problems	P3,A4		2	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 – PO4	High	Able to increase breadth and depth of knowledge through identifying and analysing various aspect of pattern recognition algorithms and selecting appropriate solution.
CO2 – PO9	High	Able to analyse and implement solution of pattern recognition tasks.
CO3- PO10	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	: CSE-445	Lecture Contact Hours	: 3.00
Course Title	: Digital Signal Processing	Credit Hours	: 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	C2	1		3	T, F

	this design examples and case study					
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	2		5	T, M, F
CO3	Analyze and implement signal processing algorithms	C4	1		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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	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-PO2	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-PO3	High	Understand and implement the design issues required to develop and analyse design signal processing algorithms.
CO4-PO4	High	Develop communication skills through participating in quiz, presentation etc.

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 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 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 Lec 20 Lec 21	Frequency domain representation 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	15%	CO2	C5
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	1,6	T, Q
CO2	Evaluate the strengths and weaknesses of	C3,C6,A4,A5,P6		2	8	T, ASG

	many popular DSP approaches.					
CO3	Appreciate the underlying mathematical relationships within and across DSP algorithms.	C2-C6,P1,A1-A2		4	2	R, Q, Pr
CO4	Design and implement various DSP algorithms in a range of real-world applications.	P3,A4,C3-C4.C6		3	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO2	High	Able to understand the complexity in analysis of data. Model selection, challenges and fundamental issues of DSP.
CO2-PO5	High	Able to identify the appropriate modern tools or learning algorithms and evaluate their strengths and weaknesses.
CO3-PO4	High	Able to appreciate the mathematical relationships and in depth investigation and experimentation of the paradigms of DSP.
CO4-PO3	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 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	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 Course Title	: CSE-449 : Mobile and Ubiquitous Computing	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 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.

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	Illustrate mobile wireless communication technologies and explain their functioning.	C1-C2			1, 3	T, F
CO2	Explain the fundamental trade-offs related to resource limitations and communication needs in mobile communication and sensing systems.	C1-C2			3	T, Mid Term Exam, F
CO3	Discover and compare the range of novel applications based upon mobile systems as well as their particular requirements.	C3-C4, A2	1		2, 3	Mid Term Exam, F, ASG
CO4	Develop the communication skill by presenting topics on mobile and ubiquitous computing.	A2		1	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)

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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					
CO4	Develop the communication skill by presenting topics on mobile and ubiquitous computing.										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

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	15%	CO 2, CO 3	C1, C2, C3, C4, A2
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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Demonstrate practical skills in developing mobile sensing applications.	H											
CO2	Design and create mobile application in team base with presentation.		H							H			
CO3	Explain the range of novel applications based upon mobile systems as well as their particular requirements.				M			H					

(H–High, M–Medium, L–Low)

JUSTIFICATION FOR CO-PO MAPPING:		
Mapping	Level	Justifications
CO1-PO1	High	Apply knowledge of mobile applications to develop practical skills.
CO2-PO2	High	Analyze each problem and propose an appropriate design.
CO2-PO9	High	Practice to work in teams as well as individual to design a mobile application.
CO3-PO4	Medium	Interpret data to discover the applications of mobile systems.
CO3-PO7	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	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	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%	CO 1, CO 2	C4, C6, P3
Viva/ presentation	10%	CO 3	C4, A2
Class Participation	10%	CO 3	C4, A2
Project	40%	CO 2	C6, P3
Final Quiz	20%	CO 1	C4

		CO 3	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	-	1,3	T
CO2	Classify various simulation models and give practical examples for each category	C2, C3	4	3	2,5	MT, F
CO3	Construct a model for a given set of data and motivate its validity	C4-C6	3	5	2	F
CO4	Develop the communication skill by presenting topics on simulation and modeling	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	For defining the basic concepts depth of knowledge will be necessary
CO2-PO4	High	Investigation and experimentation are required in order to classify different methods and to give proper example
CO3-PO3	High	Designing and development of a simulation model according to dataset
CO4-PO10	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	Introduction to Simulation Applications of Simulation	

	Lec 3	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	15%	CO2	C2-C3
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		-	2	V, R
CO2	Select and analyze output data produced by a model and test the validity of the model	C2, C4, C5		3	3	ASG,T,Q
CO3	Construct a model for a given set of data and motivate its validity	C6		5	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Generate and test random number variants and apply them to develop												H

	simulation models												
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-PO12	High	By learning to produce random variables and applying them will continue life-long preparation for various fields
CO2-PO2	High	Complex analysis is necessary to evaluate outcome of the model
CO3-PO3	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	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	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		1	T, F
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.	C2-C4, P4	1,3		1, 3	MT, F
CO3	Enable to implement the NLP technique in different application	C3, C5, C6	1,3		5,6	T, F
CO4	Develop the communication skill by presenting topics on Natural Language Processing	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Able to understand the basic concept and application of text based natural language processing
CO2-PO2	High	Apply and examine the different machine learning technique used in NLP.
CO3-PO5	High	Construct different real time application using different NLP techniques and evaluate to maximize the better performance.
CO4-PO10	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	15%	CO 2	C2-C4, P4
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		1	T, F
CO2	Familiarize with the current methods for statistical approaches to machine learning techniques used in NLP.	C2-C4, P4	1,3		1, 3	MT, F
CO3	Enable to implement the NLP technique in different application	C3, C5, C6	1,3		5,6	T, F
CO4	Develop the communication skill by presenting topics on Natural Language Processing.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO9	High	Able to understand the basic concept and application of text based natural language processing
CO2-PO7	High	Apply and examine the different machine learning technique used in NLP.
CO3-PO6	High	Construct different real time application using different NLP techniques and evaluate to maximize the better performance.
CO4-PO10	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	3
Final Examination	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		1	T, F
CO2	Assess and apply database functions and packages suitable for enterprise database development and database management.	C3-C4	1,3		1, 3	MT, F
CO3	Critically evaluate alternative designs and architectures for databases and data warehouses.	C4, C5	1,3		5,6	T, F
CO4	Discuss and evaluate methods of storing, managing and interrogating complex data.	C1-C4, A5	1,3		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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO2	High	Explain and evaluate the fundamental concept and application of database systems.
CO2-PO3	High	Apply the SQL concept to solve complex queries using database project.
CO3-PO2	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-PO2	High	Able to store, manage and interrogating the complex data
CO4-PO10	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 Lec 14 Lec 15	Distributed Database Levels of Distribution Transparency Query Processing	
6	Lec 16 Lec 17 Lec 18	Translation of Global Queries to Fragment Queries Optimization of Access Strategies Optimization of Access Strategies (Contd.)	
7	Lec 19 Lec 20 Lec 21	Transaction Processing Different Types of Transactions Different Types of Transactions (Contd.)	
8	Lec 22 Lec 23 Lec 24	Management of Distributed Transactions Concurrency Control Concurrency Control (Contd.)	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	Multimedia Database System Basic Concepts and Design	

	Lec 30	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	15%	CO 2	C3-C4
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

4. Database System Concept, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Fourth edition
5. Files and Databases- An Introduction, Peter D. Smith and G.M. Barnes, AddisonWesley
6. 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		1	T, F
CO2	Embed security aspects in the developed systems aspects of data transaction.	C4, C5	1,3		1, 3	MT, F
CO3	Explain the methods of storing, managing and interrogating complex data.	C2-C4	1,3		5,6	T, F
CO4	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO11	High	Able to understand the advance knowledge of database in commercial project.
CO2-PO6	High	Combine security aspect with better performance in data transaction.
CO3-PO7	High	Able to store, manage and interrogate complex data in commercial project.
CO4-PO10	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		3	T, F
CO2	Design the architecture and network models of IoT technology and apply appropriately to different types of industrial context.	C3, C6	2	3	5	T, MT
CO3	Analyse the challenges, security and safety issues of an IoT system.	C4	3	4	7	F
CO4	Develop the communication skill by presenting topics on information system design and development.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO1	High	Understand basic concepts IoT technology and various modules through an in-depth knowledge of architectural framework of IoT.
CO2-PO3	High	Understand how to design IoT systems appropriately by applying different types of architecture and network models for different types of industrial context.
CO3-PO2	High	Acquire knowledge for analysing the challenges of an IoT system and interpret accordingly.
CO3-PO7	Medium	Understand the security and safety issues and its impact on the components of an IoT system.
CO4-PO10	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	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	15%	CO2	C3, C6
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	5	PR, Pr, R, Viva
CO2	Analyse and evaluate appropriate communication protocols for the IoT system.	C4, C5	3	1	6	PR, Pr, R, Viva
CO3	Use modern tools to design and develop prototypes for the IoT system.	C3, C6, P4	1	1	4	PR, Pr, R, Viva
CO4	Develop the communication skill by presenting topics on software engineering sessional.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify the components and setup connections among them to design the IoT architecture for an industrial context.	H		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	L	M							
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-PO1, PO3	High, High	Acquire a strong level of knowledge to identify the components and connections for designing an IoT system for an industrial context.
CO2-PO2	High	Analyse and interpret different communication protocols to understand which protocols are appropriate for an IoT architecture.
CO3-PO2, PO3, PO4	Medium, Low, Medium	Design and develop prototypes for an IoT system architecture to solve complex industrial problems using modern engineering and IT tools.
CO4-PO10	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	Introducing IoT technology, its applications and discussion on possible innovative project ideas	-
	2		
	3		
2	4	Identifying components (devices, sensors, data storage/cloud, gateways) and relevant connectivity	Project, Report, Viva/ Presentation
	5		
	6		
3	7	Networking, loading and linking communication protocols to design the IoT architectural framework	Project, Report, Viva/ Presentation
	8		
	9		

4	10	Functioning system programming and other dependencies for the IoT system	Project, Report, Viva/ Presentation
	11		
	12		
5	13	Cloud and IoT integration and processing cloud computing services.	Project, Report, Viva/ Presentation
	14		
	15		
6	16	Developing a prototype for the IoT system	Project, Report, Viva/ Presentation
	17		
	18		
7	19	Final documentation and project submission	Project, Report, Viva/ Presentation
	20		
	21		

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, 4th industrial revolution. This course also introduces with the Millennium Development Goal (MDG) and its impact on industries in 21st 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	1	1, 2	T
CO2	Solve modern world problems using the basic knowledge of industrial revolution as well as develop ideas to approach a solution from different perspective.	C4, A2, A4, P5, P6	2		3, 4	F, T
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	3, 5, EP2	3, 5	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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	Introduction to 4th Industrial Revolution	

	Lec 24		
9	Lec 25	4IRs	
	Lec 26	Study of Workforce readiness	
	Lec 27	Soft Skills	
10	Lec 28	Technical Skills	
	Lec 29		
	Lec 30		
11	Lec 31	Entrepreneurship	Class Test-3
	Lec 32		
	Lec 33		
12	Lec 34	Global Effects of Industrialization	
	Lec 35	Local Effects of Industrialization	
	Lec 36		
13	Lec 37	MDG and its impact on Industrial Revolution	
	Lec 38		
	Lec 39		
14	Lec 40	Debates	
	Lec 41	Histography	
	Lec 42	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	15%	CO2	C4, P6
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	1	6	T, Q
CO2	Evaluate the strengths and weaknesses of many industries.	C3, C6, A4, A5, P6	2	2	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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 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

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		1,3,6	T, MT, F
CO2	Analyse the requirements of a comprehensive security plan for an organization.	C4	1		3	T, F, MT
CO3	Design and customize a comprehensive security plan by integrating network defense tools and measures.	C3, C6	1		1,3,8	F, MT
CO4	Develop communication skill by presenting topics on cyber and physical security.	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

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)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Apply cybersecurity principles and methods to defend an information	H											

	system against cyber threats.												
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- PO1	High	Interpret the principles and methods of cyber security by developing breadth and depth of knowledge and understanding in the respective areas.
CO2 - PO1	High	Gain depth of knowledge for analysing the principles and methods of cyber security and their execution process.
CO3 – PO2	Medium	Gain preliminary experience in complex problem analysis by designing a comprehensive security plan.
CO4- PO10	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	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 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…	Class Test 3
13	Lec 37 Lec 38 Lec 39	Privacy in Cyber-Physical Systems	
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	15%	CO1	C1, C2
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	8	E, Q
CO2	Understand and recognize instances of the principal attacks on such systems	C3, A5		2	6	ASG, Q
CO3	Take appropriate measures to protect systems from security breaches	P3, A4		2	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)											
		1	2	3	4	5	6	7	8	9	10	11	12
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-PO4	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-PO2	High	Will be able to do problem analysis by understanding and recognizing instances of the principal attacks on such systems
CO3-PO6	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	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	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%)	Evaluation and Assignment	30%	CO1	C2, A2
			CO2	C3, A5
	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. 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

Mission of MIST

MIST is working on the following missions:

1. Provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology, and engineering management.
2. Produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio-economic development of Bangladesh and global needs.
3. Conduct collaborative research activities with national and international communities for continuous interaction with academia and industry.
4. 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.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

After completing the B.Sc. in CSE program the graduates are expected to have the following skills:

1. Graduates will grow and develop in their chosen profession and/or progress toward an advanced degree by giving innovative solutions to complex problems.
2. Graduate will earn respects from others and demonstrate reliability as effective and ethical team members and achieve positions of leadership in an organization and/or on teams.
3. Graduates will be able to establish or run sustainable business enterprises along diverse career paths by creating, selecting, applying appropriate and modern technologies, skills and tools.
4. Graduates will be able contribute to the educational, cultural, social, technological and economic development of society through the ethical application of their knowledge and skills.

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. B.Sc. in CSE program of MIST has 12 Program Outcomes. They are briefly described in the following table.

Serial	PO	Category	Description
1	**PO1**	**Engineering Knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO2**	**Problem Analysis**	Identify, formulate, research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO3**	**Design/Development of Solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
4	**PO4**	**Investigation**	Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5	**PO5**	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction

			and modeling to complex engineering activities with an understanding of the limitations.
6	**PO6**	**The Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, And cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO7**	**Environment and Sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8	**PO8**	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO9**	**Individual and Team Work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO10**	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentation and give and receive clear instructions.
11	**PO11**	**Project management and Finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	**PO12**	**Lifelong learning**	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Table: List of Program Outcomes

PEOs MAPPING WITH THE INSTITUTIONAL MISSION

Relationship between the Program educational Outcomes and Mission of MIST is stated below:

No.	**PEO Statements**	**Industrial missions**			
		Mission Statement-1	Mission Statement-2	Mission Statement-3	Mission Statement-4
PEO-1	Growth and development in their chosen profession and/or progress towards an advanced degree by giving innovative solutions to complex problems.	Yes	No	No	Yes
PEO-2	Demonstrate trust & respect for others and be an effective and ethical team member and thereby achieve positions of leadership in an organization and/or team.	No	Yes	No	No
PEO-3	Graduates will be able to establish and run sustainable business enterprises along diverse career paths by creating, selecting, applying appropriate and modern technologies, skills and tools.	No	Yes	Yes	Yes
PEO-4	Graduates will be able to contribute in to the educational, cultural, social, technological and economic development of society through the ethical application of their knowledge and skills.	No	Yes	Yes	No

Table: Relationship between PEOs and Mission of MIST

RELATIONSHIP BETWEEN THE POs AND PEOs

Relationship between POs and PEOs of MIST is given in details below:

No.	PO statement	PEO-1	PEO-2	PEO-3	PEO-4
PO-1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	Yes	No	No	No
PO-2	Problem analysis: Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.	Yes	No	No	No
PO-3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.	Yes	No	No	No
PO-4	Investigation: Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.	Yes	No	No	No
PO-5	Modern tool usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.	No	No	Yes	No
PO-6	The engineer and society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	No	Yes	No	Yes
PO-7	Environment and sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.	No	No	Yes	Yes
PO-8	Ethics: Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.	No	Yes	No	Yes
PO-9	Individual work and teamwork: Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.	No	Yes	No	No
PO-10	Communication: Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.	No	Yes	No	Yes
PO-11	Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.	No	Yes	Yes	No
PO-12	Life-long learning: Recognize the need for and	Yes	Yes	No	Yes

	have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.				

Table: Relationship between PEOs and Mission of MIST

KNOWLEDGE PROFILES (KP)

The Table: Knowledge Profiles defines indicated volume of learning and attributes against which graduates must be able to perform. The table is used to extend and clarify the definition of the Graduate Attributes (see the PO list above).

KP	Category	Description
KP1	Natural Sciences	A systematic, theory-based understanding of the natural sciences applicable to the discipline.
KP2	Mathematics	Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.
KP3	Engineering Fundamentals	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
KP4	Specialist Knowledge	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
KP5	Engineering Design	Knowledge that supports engineering design in a practice area.
KP6	Engineering Practice	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
KP7	Societal Roles	Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability.
KP8	Research Literature	Engagement with selected knowledge in the research literature of the discipline.

Table: Knowledge Profiles

RANGE OF COMPLEX ENGINEERING PROBLEM (CP)

The Table: Complex Engineering Problem Profiles clarifies the definition of Complex Engineering Problem by establishing seven range, or characteristics, of problem-solving. Based on this list of CP, the attributes of a Complex Engineering Problem is that it must have CP1 and some or all of CP2 to CP7.

CP	Attributes	Description
CP1	Depth of knowledge required	Cannot be resolved without in-depth engineering knowledge at the level of one or more of KP3, KP4, KP5, KP6 or KP8 which allows a fundamentals-based, first principles analytical approach.
CP2	Range of conflicting requirements	Involve wide-ranging or conflicting technical, engineering and other issues.
CP3	Depth of analysis required	Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models.
CP4	Familiarity of issues	Involve infrequently encountered issues.
CP5	The extent of applicable codes	Are outside problems encompassed by standards and codes of practice for professional engineering.
CP6	The extent of stakeholder involvement and conflicting requirements	Involve diverse groups of stakeholders with widely varying needs.
CP7	Interdependence	Are high-level problems including many component parts or sub-problems.

Table: Complex Engineering Problem Profiles

RANGE OF COMPLEX ENGINEERING ACTIVITIES (CA)

There are five attributes of activities where students can be involved in when solving Complex Engineering Activities, as defined in the International Engineering Alliance (IEA) document for the Washington Accord graduates (Professional). A Complex Engineering Activity or Project is that which has some or all of the following attributes:

CA	Attributes	Description
CA1	Range of resources	Involve the use of diverse resources (and for this purpose resource includes people, money, equipment, materials, information and technologies).
CA2	Level of interactions	Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues.
CA3	Innovation	Involve creative use of engineering principles and research-based knowledge in novel ways.
CA4	Consequences to society and the environment	Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation.
CA5	Familiarity	Can extend beyond previous experiences by applying principles-based approaches.

Table: Range of Complex Engineering Activities

LEARNING DOMAINS (LD)

The Learing Domain (LD) consists of three sub-domains i.e. cognitive, affective, and psychomotor and their categories. The students will be evaluated through different methods based on the sub-domains. The attributes of the sub-domains are described in the following tables.

Cognitive sub-domain:

LD	Category	Description
C1	Remembering	Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce definitions, facts, or lists, or recite or retrieve material.
C2	Understanding	Constructing meaning from different types of functions be they have written or graphic messages activities like interpreting, exemplifying classifying, summarizing, inferring, comparing, and explaining.
C3	Applying	Carrying out or using a procedure through executing, or implementing. Applying related and refers to situations where learned material is used through products like models, presentations, interviews or simulations.
C4	Analyzing	Breaking material or concepts into parts, determining how the parts relate or interrelate to one another or to an overall structure or purpose. Mental actions included in this function are differentiating, organizing, and attributing, as well as being able to distinguish between the components or parts. When one is analyzing he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations.
C5	Evaluating	Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. In the newer taxonomy evaluation comes before creating as it is often a necessary part of the precursory behaviour before creating something.
C6	Creating	Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way or synthesize parts into something new and different a new form or product. This process is the most difficult mental function in the new taxonomy.

Table: Cognitive Domain

Affective sub-domain:

LD	Category	Description
A1	Receiving	This refers to the learner's sensitivity to the existence of stimuli – awareness, willingness to receive, or selected attention.
A2	Responding	This refers to the learners' active attention to stimuli and his/her motivation to learn – acquiescence, willing responses, or feelings of satisfaction.
A3	Valuing	This refers to the learner's beliefs and attitudes of worth – acceptance, preference, or commitment. An acceptance, preference, or commitment to value.
A4	Organization	This refers to the learner's internalization of values and beliefs involving (1) the conceptualization of values; and (2) the organization of a value system. As values or beliefs become internalized, the leaner organizes them according to priority.
A5	Characterization	This refers to the learner's highest of internalization and relates to behaviour that reflects (1) a generalized set of values; and (2) a characterization or a philosophy about life. At this level, the learner is capable of practising and acting on their values or beliefs.

Table: Affective Domain

Psychomotor sub-domain:

LD	Category	Description
P1	Perception	The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.
P2	Set	Readiness to act. It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets).
P3	Guided Response	The early stages in learning a complex skill that includes imitation and trial and error. Adequacy of performance is achieved by practicing.
P4	Mechanism	This is the intermediate stage in learning a complex skill. Learned responses have become habitual and the movements can be performed with some confidence and proficiency.
P5	Complex / Overt Response	The skilful performance of motor acts that involve complex movement patterns. Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation and automatic performance. For example, players often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football because they can tell by the feel of the act what the result will produce.
P6	Adaptation	Skills are well developed and the individual can modify movement patterns to fit special requirements.
P7	Origination	Creating new movement patterns to fit a particular situation or specific problem. Learning outcomes emphasize creativity based on highly developed skills.

Table: Psychomotor Domain

APPENDIX B

TYPES OF EXAM AND ASSOCIATED ISSUES

Ser	Exam Type	Term	No of Theory Courses	Max Grading	Assessment Marks	Exam Schedule	Courses	Registration schedule
1	Regular	Spring and Fall	Max 6 Theory Courses	A+	Assessment on 100%	Regular exam	Regular	Regular
2	Retake	Spring and Fall		B+				
3	Supplementary-I (Fail/ Improvement)	Spring	Max 2 Theory	B+	Assessment on 60%	1st wk of Spring Term/ Fall Term End Break	Courses of immediate past term included	5th wk after completion of Fall Term (Previous Yr)
4	Supplementary –II (Fail/ Improvement)	Fall	Max 1 Theory	B+	Assessment on 60%	1st wk of Fall Term/ Spring Term End Break	Courses of immediate past term not included	Mid-term break of Spring Term (March)

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 C

EQUIVALENCE TABLE

	Old course(2019-2021)			New Course (2022-2024)		
Ser.	Course code	Course Title	Cr.	Course code	Course Title	Cr.
1.	CSE-100	Introduction to Computer Systems Sessional	1.50	-	-	-
2.	CSE -101	Discrete Mathematics	3.00	CSE -101	Discrete Mathematics	3.00
3.	CHEM-101	Chemistry	3.00	CHEM-101	Introduction to chemistry for Engineers	3.00
4.	-	-	-	CHEM-102	Chemistry Sessional	1.50
5.	EECE-163	Electrical Circuit Analysis	3.00	EECE-163	Electrical Circuit Analysis	3.00
6.	EECE-164	Electrical Circuit Analysis Sessional	1.50	EECE-164	Electrical Circuit Analysis Sessional	0.75
7.	HUM-101	Developing English Language Skills I	2.00	ENG-102	Communicative English-I	1.50
8.	MATH-141	Mathematics-I (Differential and Integral Calculus)	3.00	MATH-101	Differential and Integral Calculus	3.00
9.	PHY-103	Physics	3.00	PHY-101	Waves and Oscillations, Optics and Modern Physics	3.00
10.	PHY-104	Physics Sessional	0.75	PHY-102	Physics Sessional	1.50
11.	Shop-140	Workshop Practice Sessional	0.75	-	-	-
12.	CSE-201	Digital Logic Design	3.00	CSE-103	Digital Logic Design	3.00
13.	CSE-202	Digital Logic Design Sessional	1.50	CSE-104	Digital Logic Design Sessional	1.50
14.	CSE-105	Structured Programming Language	3.00	CSE-105	Structured Programming Language	3.00
15.	CSE-106	Structured Programming Language Sessional	1.50	CSE-106	Structured Programming Language Sessional	1.50
16.	EECE-169	Electronic Devices and Circuits	3.00	EECE-169	Electronic Devices and Circuits	3.00
17.	EECE-170	Electronic Devices and Circuits Sessional	1.50	EECE-170	Electronic Devices and Circuits Sessional	0.75
18.	HUM-241	Bangladesh Studies	2.00	GEBS-101	Bangladesh Studies	2.00
19.	MATH-245	Mathematics-III (Vector Analysis, Matrices and Fourier Analysis)	3.00	MATH-105	Vector Analysis, Matrix and Coordinate Geometry	3.00
20.	ME - 181	Basic Mechanical Engineering	2.00	ME-122	Fundamental of Mechanical Engineering and Robotics Sessional	2.00
21.	CSE-203	Data Structures and Algorithms-I	3.00	CSE-203	Data Structures and Algorithms-I	3.00
22.	CSE-204	Data Structures and	1.50	CSE-204	Data Structures and	1.50

	Old course(2019-2021)				New Course (2022-2024)		
Ser.	**Course code**	**Course Title**	**Cr.**		**Course code**	**Course Title**	**Cr.**
		Algorithms-I Sessional				Algorithms-I Sessional	
23.	CSE-205	Object Oriented Programming Language	3.00		CSE-205	Object Oriented Programming Language	3.00
24.	CSE-206	Object Oriented Programming Language Sessional-I	1.50		CSE-206	Object Oriented Programming Language Sessional-I	1.50
25.	CSE-217	Theory of computation	3.00		CSE-217	Theory of computation	3.00
26.	EECE-269	Electrical Drives and Instrumentation	3.00		EECE-269	Electrical Drives and Instrumentation	3.00
27.	EECE-270	Electrical Drives and Instrumentation Sessional	0.75		EECE-270	Electrical Drives and Instrumentation Sessional	0.75
28.	HUM-237	Engineering Economics	2.00				
29.	HUM-102	Developing English Language Skills II	1.50		ENG-302	Communicative English-II	1.50
30.	MATH-143	Mathematics-II (Ordinary and Partial Differential Equations and Coordinate Geometry)	3.00		-	-	-
31.	-	-	-		MATH-205	Differential Equations, Laplace Transform and Fourier Transform	3.00
32.	CE-150	Engineering Drawing and CAD Sessional	1.50		CE-250	Engineering Drawing and CAD Sessional	1.50
33.	CSE-323	Computer Architecture	3.00		CSE-213	Computer Architecture	3.00
34.	CSE-214	Numerical Methods Sessional	1.50				
35.	CSE-215	Data Structures and Algorithms-II	3.00		CSE-215	Data Structures and Algorithms-II	3.00
36.	CSE-216	Data Structures and Algorithms-II Sessional	1.50		CSE-216	Data Structures and Algorithms-II Sessional	1.50
37.	CSE-313	Mathematical Analysis for Computer Science	3.00		CSE-219	Mathematical Analysis for Computer Science	2.00
38.	CSE-220	Object Oriented Programming Sessional-II	1.50		CSE-220	Object Oriented Programming Sessional-II	0.75
39.	CSE -224	Advanced Programming Language Sessional	0.75				
40.	CSE-211	Digital Electronics and Pulse Technique	3.00		EECE-279	Digital Electronics and Pulse Technique	3.00
41.	CSE-212	Digital Electronics and Pulse Technique Sessional	0.75		EECE-280	Digital Electronics and Pulse Technique Sessional	0.75
42.	-	-	-		GELM-271	Leadership and Management	2.00
43.	MATH-247	Mathematics-IV (Complex Variable, Laplace Transform and Statistics))	3.00				
44.	-	-	-		MATH-207	Complex Variable and Statistics	3.00
45.	CSE-301	Database Management Systems	3.00		CSE-301	Database Management Systems	3.00
46.	CSE-302	Database Management Systems Sessional	1.50		CSE-302	Database Management Systems Sessional	1.50

	Old course(2019-2021)			New Course (2022-2024)		
Ser.	Course code	Course Title	Cr.	Course code	Course Title	Cr.
47.	CSE-303	Compiler	3.00	CSE-303	Compiler	3.00
48.	CSE-304	Compiler Sessional	0.75	CSE-304	Compiler Sessional	0.75
49.	CSE-305	Microprocessors, Micro-controllers and Assembly Language	4.00	CSE-305	Microprocessors, Micro-controllers and Assembly Language	3.00
50.	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.50	CSE-306	Microprocessors, Micro-controllers and Assembly Language Sessional	1.50
51.	CSE-307	Operating System	3.00	CSE-307	Operating System	3.00
52.	CSE-308	Operating System Sessional	0.75	CSE-308	Operating System Sessional	0.75
53.	CSE-317	Data Communication	3.00	CSE-317	Data Communication	3.00
54.	CSE-318	Data Communication Sessional	0.75	CSE-318	Data Communication Sessional	0.75
55.	CSE-309	Computer Network	3.00	CSE-309	Computer Network	3.00
56.	CSE-310	Computer Network Sessional	1.50	CSE-310	Computer Network Sessional	1.50
57.	CSE-315	Digital System Design	3.00	CSE-315	Digital System Design	3.00
58.	CSE-316	Digital System Design Sessional	0.75	CSE-316	Digital System Design Sessional	0.75
59.	CSE-319	Software Engineering	3.00	CSE-319	Software Engineering	3.00
60.				CSE-320	Software Engineering Sessional	0.75
61.	CSE-360	Integrated Design Project/Capstone Project-I	1.50	-	-	-
62.	CSE-460	Integrated Design Project/Capstone Project-II	3.00	-	-	-
63.				CSE-364	Software Development Project - I	1.50
64.				GERM-306	Fundamentals of Research Methodology	2.00
65.	HUM-243	Sociology	2.00	GES-301	Fundamentals of Sociology	2.00
66.				GESL-303	Environment, Sustainability and Law	2.00
67.	CSE-350	Industrial Training	1.00	CSE-350	Industrial Training	1.00
68.	CSE-400	Thesis	4.50	CSE-400	Final Year Research Project	6.00
69.	CSE-405	Computer Interfacing	3.00	CSE-405	Computer Interfacing	3.00
70.	-	-	-	CSE-406	Computer Interfacing Sessional	0.75
71.	CSE-415	Human computer Interaction	3.00	CSE-415	Human computer Interaction	3.00
72.	CSE-416	Human computer Interaction Sessional	0.75			
73.	CSE-429	Computer Security	3.00	CSE-429	Computer Security	3.00
74.	-	-	-	CSE-464	Software Development Project-II	1.50
75.	-	-	-	GEEM-401	Engineering Ethics and Moral Philosophy	2.00
76.	CSE-401	Information System Design	3.00	CSE-401	Information System	3.00

	Old course(2019-2021)			New Course (2022-2024)		
Ser.	**Course code**	**Course Title**	**Cr.**	**Course code**	**Course Title**	**Cr.**
		and Development			Design and Development	
77.	CSE-402	Information System Design and Development Sessional	0.75	-	-	-
78.	CSE-403	Artificial Intelligence	3.00	CSE-403	Artificial Intelligence	3.00
79.	CSE-404	Artificial Intelligence Sessional	0.75	CSE-404	Artificial Intelligence Sessional	0.75
80.	CSE-413	Computer Graphics	3.00	CSE-413	Computer Graphics	3.00
81.	CSE-414	Computer Graphics Sessional	0.75	CSE-414	Computer Graphics Sessional	0.75
82.	HUM-415	Financial and Managerial Accounting	2.00	GEPM-411	Project Management and Finance	2.00
83.	HUM-417	Engineering Management and Ethics	3.00	-	-	-
84.	CSE-407	Applied Statistics and Queuing Theory	3.00	CSE-407	Applied Statistics and Queuing Theory	3.00
85.	CSE-419	Advanced Algorithms	3.00	CSE-419	Advanced Algorithms	3.00
86.	CSE-421	Basic Graph Theory	3.00	CSE-421	Basic Graph Theory	3.00
87.	CSE-423	Fault Tolerance System	3.00	CSE-423	Fault Tolerance System	3.00
88.	CSE-425	Basic Multimedia Theory	3.00	CSE-425	Basic Multimedia Theory	3.00
89.	CSE-427	Digital Image Processing	3.00	CSE-427	Digital Image Processing	3.00
90.	CSE-431	Object Oriented Software Engineering	3.00	CSE-431	Object Oriented Software Engineering	3.00
91.	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00	CSE-433	Artificial Neural Networks and Fuzzy Systems	3.00
92.	CSE-435	Distributed Algorithms	3.00	CSE-435	Distributed Algorithms	3.00
93.	CSE-437	Bioinformatics	3.00	CSE-437	Bioinformatics	3.00
94.	CSE-439	Robotics	3.00	CSE-439	Robotics	3.00
95.	CSE-447	Telecommunication Engineering	3.00	CSE-447	Telecommunication Engineering	3.00
96.	CSE-411	VLSI Design	3.00	CSE-411	VLSI Design	3.00
97.	CSE-412	VLSI Design Sessional	0.75	CSE-412	VLSI Design Sessional	0.75
98.	CSE-441	Machine Learning	3.00	CSE-441	Machine Learning	3.00
99.	CSE-442	Machine Learning Sessional	0.75	CSE-442	Machine Learning Sessional	0.75
100.	CSE-443	Pattern Recognition	3.00	CSE-443	Pattern Recognition	3.00
101.	CSE-444	Pattern Recognition Sessional	0.75	CSE-444	Pattern Recognition Sessional	0.75
102.	CSE-453	Data Ware-housing and Data Mining	3.00	-	-	-
103.	CSE-454	Data Ware-housing and Data Mining Sessional	1.50	-	-	-
104.	CSE-445	Digital Signal Processing	3.00	CSE-445	Digital Signal Processing	3.00
105.	CSE-446	Digital Signal Processing Sessional	0.75	CSE-446	Digital Signal Processing Sessional	0.75
106.	CSE-449	Mobile and Ubiquitous Computing	3.00	CSE-449	Mobile and Ubiquitous Computing	3.00

	Old course(2019-2021)			New Course (2022-2024)		
Ser.	**Course code**	**Course Title**	**Cr.**	**Course code**	**Course Title**	**Cr.**
107.	CSE-450	Mobile and Ubiquitous Computing Sessional	0.75	CSE-450	Mobile and Ubiquitous Computing Sessional	0.75
108.	CSE- 451	Simulation and Modeling	3.00	CSE- 451	Simulation and Modeling	3.00
109.	CSE- 452	Simulation and Modeling Sessional	0.75	CSE- 452	Simulation and Modeling Sessional	0.75
110.	CSE-455	Natural Language Processing using Deep Learning	3.00	CSE-455	Natural Language Processing	3.00
111.	CSE-456	Natural Language Processing using Deep Learning sessional	0.75	CSE-456	Natural Language Processing sessional	0.75
112.	CSE-457	Advanced Database Management Systems	3.00	CSE-457	Advanced Database Systems	3.00
113.	CSE-458	Advanced Database Management Systems Sessional	0.75	CSE-458	Advanced Database Systems Sessional	0.75
114.	-	-		CSE-417	Blockchain and Cryptocurrenct Technology	3.00
115.	-	-		CSE-459	Internet of Things (IoT)	3.00
116.	-	-		CSE-460	Internet of Things (IoT) Sessional	0.75
117.	-	-		CSE-461	Industrial Revolution	3.00
118.	-	-		CSE-462	Industrial Revolution	0.75
119.	-	-		CSE-465	Cyber & Physical Security	3.00
120.	-	-		CSE-466	Cyber & Physical Security Sessional	0.75