B.S. Abdur Rahman ™
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2021
Curriculum and Syllabi
(Updated upto December 2023, as per 21st Academic Council)

B.Tech. CSE

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REGULATIONS 2021

CURRICULUM AND SYLLABI

(Updated upto December 2023 as per 21st Academic Council)

B.TECH. COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION OF THE INSTITUTION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership skills in students through various co-curricular and extra – curricular activities
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Computer Science and Engineering graduate can

PEO 1: Apply Engineering and Technology concepts for solving problems in a variety ofdomains.

PEO 2: Formulate ethical and sustainable solutions for complex problems by applying knowledge of mathematics, algorithmic principles, and engineering for the cultural, societal, and environmental considerations.

PEO 3: Equip with designing and modeling using cutting edge technologies across a broadrange of realms.

PEO 4: Adapt to the changing technological advancements and engage in continuing research and professional development.

PEO 5: Be successful as computing professionals and entrepreneurs with good interpersonal skills, social commitment and societal responsibilities.

PROGRAM OUTCOMES (POS)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering
fundamentals and an engineering specialization to the solution of complex engineering
problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriateconsideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of theinformation to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activitieswith an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant tothe professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineeringsolutions in societal and environmental

contexts, and demonstrate the knowledge of, and needfor sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities andnorms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leaderin diverse teams and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with theengineering community and with society at large, such as, being able to comprehend and writeeffective reports and design documentation, make effective presentations and give and receiveclear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member andleader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAMME SPECIFIC OUTCOMES

PSO1: Understand, analyze and develop essential proficiency in the areas related to algorithms, system software, multimedia, web design, big data analytics, networking, security and apply the acquired knowledge to solve practical problems.

PSO2: Apply standard practices and strategies in hardware and software project development using open-ended programming environments for successful career and entrepreneurship.

REGULATIONS - 2021

B.TECH. DEGREE PROGRAMMES

(Under Choice Based Credit System)

(Amendments Approved by the 19th Academic Council – September 2022)

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means theory / practical / laboratory integrated theory / seminar / internship / project and any other subject that is normally studied in a semester like English, Mathematics, Environmental Science, Engineering Graphics, Electronic Devices etc.,

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) ofthe Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations ofthe Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B. Tech. degree programme shall be required to have passed the Higher Secondary Examination of the 10+2 curriculum

(Academic stream) prescribed by the appropriate authority or any other examination of any University or authority accepted by the Institution as equivalent thereto.

2.1b) The student shall have studied at least any three of the following courses: Physics, Mathematics, Chemistry, Computer Science, Electronics, Information Technology, Biology, Informatics Practices, Biotechnology, Technical Vocational Subjects, Agriculture, Engineering Graphics, Business Studies, Entrepreneurship at 10+2 level. In case if the student has not studied any or all the courses viz., mathematics, physics and chemistry, he / she shall undergo bridge course(s) in the concerned course(s) at 10+2 level knowledge.

2.2 Notwithstanding the qualifying examination, the candidate might have passed at 10+2, the candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in the courses considered eligible for admission on the standards prescribed for 10+2 academic stream.

2.3 Candidates for admission to the third semester of the eight semester B.Tech.programme under lateral entry category shall be required to have passed minimum Three years / Two years (Lateral Entry) Diploma examination in any branch of Engineering / Technology or passed B.Sc. Degree from a recognized University as defined by UGC and passed 10+2 examination with Mathematics as a subject or Passed three year Diploma of Vocation Stream (D.Voc) in the same or allied sector or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.4 The Institution shall offer suitable bridge courses in Mathematics, Physics, Engineering drawing, etc., for the students of diverse backgrounds.

2.5 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution in adherence to the guidelines of regulatory authorities from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. Degree programmes in various branches of Engineering and Technology,

each distributed over eight semesters, with two semesters per academic year.

1. Aeronautical Engineering
2. Artificial Intelligence and Data Science
3. Automobile Engineering
4. Biotechnology
5. Civil Engineering
6. Computer Science and Engineering
7. Computer Science and Engineering (Cyber Security)
8. Computer Science and Engineering (Internet of Things)
9. Electrical and Electronics Engineering
10. Electronics and Communication Engineering
11. Electronics and Instrumentation Engineering
12. Information Technology
13. Mechanical Engineering
14. Polymer Engineering

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every programme has a curriculum with syllabi consisting of theory and practical courses such as,

i) Basic Science Courses - BSC
ii) Humanities and Social Sciences including Management Courses - HSC
iii) Engineering Science Courses - ESC
iv) Professional Core Courses - PCC
v) Professional Elective Courses - PEC
vi) Open Elective Courses - OEC
vii) Laboratory Courses– LC
viii) Laboratory Integrated Theory Courses – LITC
ix) Mandatory Courses- MC
x) Project - PROJ (Project work, seminar and internship in industry or at appropriate workplace)

4.1.1 Mandatory Induction Programme for First year Students

The first year students upon admission shall undergo a mandatory three week induction programme consisting of physical activity, creative arts, universal human values, literary, proficiency modules, lectures by eminent people, visits to local

areas, familiarization with departments / schools and centres, etc.,

4.1.2 Personality and Character Development

All students shall enroll, on admission, in any of the following personality and character development programmes:

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO)
- Youth Red Cross (YRC)
- Rotaract
- Crescent Indian Society Training Development(ISTD–C)
- Crescent Creative Strokes
- Crescent Technocrats club

The training activities / events / camp shall normally be organized during the weekends / vacation period.

4.1.3 Online Courses for Credit Transfer

Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean (Academic Affairs) during his / her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

4.1.4 Value Added Courses

The students are permitted to pursue department approved online courses (excluding courses registered for credit transfer) or courses offered / approved by the department as value added courses.

The details of the value added course viz., syllabus, schedule of classes and the course faculty shall be sent to the Dean (Academic Affairs) for approval. The students may also undergo the valued added courses offered by other departments with the consent of the Head of the Department offering the course.

These value added courses shall be specified in the consolidated mark sheet as additional courses pursued by the student over and

above the curriculum during the period of study.

4.1.5 Industry Internship

The students shall undergo training for a period as specified in the curriculum during the summer vacation in any industry relevant to the field study.

The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period prescribed in the curriculum during the summer vacation, in lieu of Industrial training.

In any case, the student shall obtain necessary approval from the Head of the Department / Dean of School and the training has to be taken up at a stretch.

4.1.6 Industrial Visit

The student shall undergo at least one industrial visit every year from the second year of the programme. The Heads of Departments / Deans of Schools shall ensure the same.

4.2 Each course is normally assigned certain number of credits:

- one credit per lecture period per week
- one credit per tutorial period per week
- one credit for two to three periods and two credits for four periods of laboratory or practical sessionsper week
- one credit for two periods of seminar / project work per week
- one credit for two weeks of industrial training or 80 hours per semester.

4.3 Each semester curriculum shall normally have a blend of lecture courses, laboratory courses, laboratory integrated theory courses, etc.

4.5 The medium of instruction, examinations and project report shall be in English, except for courses in languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is expected to complete the B.Tech. programme in eight semesters (six semesters in the case of lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry students).

5.2 Each semester shall consist of a minimum of 90 working days including the days of examinations.

5.3 The maximum duration for completion of the programme as mentioned in clause 5.1 shall also include period of break of study vide clause 7.1 so that the student may be eligible for the award of the degree.

6.0 REGISTRATION AND ENROLLMENT

6.1 The students of first semester shall register and enroll for courses at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

6.2 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

6.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.0 BREAK OF STUDY FROM PROGRAMME

7.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

7.1.1 Medical or other valid grounds

7.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

7.1.3 Debarred due to any act of indiscipline

7.2 The total duration for completion of the programme shall not exceed theprescribed maximum number of semesters (vide clause 5.1).

7.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

7.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade

courses and appear for the arrear examinations.

8.0 CLASS ADVISOR AND FACULTY ADVISOR

8.1 Class Advisor

A faculty member shall be nominated by the Head of the Department as class advisor for the class throughout the period of study except first year.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

However, for the first and second semester, the class advisors (first year class advisors) are nominated by the first year coordinator.

8.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling, the Head of the Department of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

9.0 COURSE COMMITTEE

9.1 Each common theory course offered to more than one group of students shall have a “Course Committee” comprising all the course faculty teaching the common course with one of them nominated as a course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending on whether all the course faculty teaching the common course belong to a single department or from several departments. The course committee shall ensure preparation of a common question paper and scheme of evaluation for the tests and semester end examination.

10.0 CLASS COMMITTEE

A class committee is constituted branch wise and semester wise by the Head of the Department / Dean of the School shall normally comprise of faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman.

10.1 The composition of class committees for first and second semester is as follows:

i) The first year coordinator shall be the chairman of the class committee

ii) Faculty members of all individual courses of first / second semester

iii) Six student representatives (male and female) of each class nominated by the first year coordinator

iv) The class advisor and faculty advisors of the class

10.2 The composition of the class committee for each branch from 3rd to 8th semester is as follows:

i) One senior faculty member preferably not handling courses for the concerned semester appointed as chairman by the Head of the Department

ii) All the faculty members handling courses of the semester

iii) Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors

iv) All faculty advisors and the class advisors

v) Head of the Department

10.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the components of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

10.4 During these two meetings, the student members shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi, etc.

10.5 The third meeting of the class committee, excluding the student members, shall meet after the semester end examinations to analyse the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course

committee and shall be presented to the class committee(s) by the course facultyconcerned.

11.0 CREDIT LIMIT FOR ENROLLMENT & MOVEMENT TO HIGHER SEMESTER

11.1 A student can enroll for a maximum of 32 credits during a semester including Redo / Predo courses.

11.2 The minimum credits earned by the student to move to 7th semester shall not be less than 60 credits (40 credits for lateral entry students).

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 6	1.5 hours	25%
Assessment 2	7 to 12	1.5 hours	25%
Semester End Examination	Full course	3 hours	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 60% weightage for continuous assessments and 40% for semester end examination. However, a student shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory components

shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

12.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by the Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the viva voce examination.

12.8 Assessment of seminars and comprehension shall be carried out by a committee of faculty members constituted by the Head of the Department.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular

and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab components.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of the School for that purpose. There is no substitute examination for semester end examinations.

13.2 A student shall apply for a substitute exam in the prescribed form to the Head of the Department / Dean of the School within a week from the date of assessment test. However, the substitute examination will be conducted only after the last instructional day of the semester.

14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

14.1A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded “I” grade in that course.

14.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

14.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons

(hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

14.4 A student who has obtained an "I" grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat all the courses of the semester in the subsequent academic year.

14.5 The student awarded "I" grade, shall enroll and repeat the course when it is offered next. In case of "I" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

14.6 A student who is awarded "U" grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

14.7 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

15.0 REDO COURSES

15.1 A student can register for a maximum of three redo courses per semester without affecting the regular semester classes, whenever

such courses are offered by the concerneddepartment, based on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

15.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course shall be made on absolute marks basis. The class committee without the student members shall meet to analyse the performance of students in all assessments of a course and award letter grades following the relative grading system. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-

"W" - denotes withdrawal from the course

“I” - denotes inadequate attendance in the course and prevention from appearance of semester end examination

“U” - denotes unsuccessful performance in the course.

16.2 A student who earns a minimum of five grade points (‘E’ grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

16.3 Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further

approve and declare the results.

16.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

16.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course,

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I” and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage equivalent of marks = CGPA X 10

16.6 After successful completion of the programme, the degree shall be

awarded to the students with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semesters for all students (except lateral entry students) and 6 semesters for lateral entry students
First Class	6.50 and above and completing the programme within a maximum of 10 semesters for all students (except lateral entry students) and 8 semesters for lateral entry students
Second Class	Others

16.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the UG programme within the minimum prescribed period of study (except clause 7.1.1)

16.6.2 Eligibility for First Class

- A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 7.1.1)

16.6.3 The students who do not satisfy clause 16.6.1 and clause 16.6.2 shall be classified as second class.

16.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

17.0 SUPPLEMENTARY EXAMINATION

Final year students and passed out students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise, students with less credits in VI semester can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester.

The students can apply for supplementary examination within three weeks of the declaration of results in the even semester.

18.0 DISCIPLINE

18.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

18.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Head of the Department / Dean of the School concerned shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action. This committee shall also address the grievances related to the conduct of online classes.

19.0 ELIGIBILITY FOR THE AWARD OF DEGREE

19.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

i) Successfully earned the required number of total credits as specified in the curriculum of the programme of study within a maximum period of 14 semesters (12 semesters for lateral entry) from the date of admission, including break of study.

ii) Successfully completed the requirements of the enrolled professional development activity.

iii) No dues to the Institution, Library, Hostel, etc.

iv) No disciplinary action pending against him/her.

19.2 The award of the degree must have been approved by the Institution.

20.0 MINOR DEGREE PROGRAMMES OFFERED FOR STUDENTS

20.1 The students admitted in the following B.Tech. programmes can graduate with a minor degree, which is optional, along with a major degree:

- Civil Engineering
- Electronics and Communication Engineering
- Automobile Engineering
- Polymer Engineering
- Electronics and Instrumentation Engineering
- Mechanical Engineering
- Electrical and Electronics Engineering
- Aeronautical Engineering
- Biotechnology Engineering
- Computer Science and Engineering

- Information Technology
- Computer Science and Engineering (IoT)
- Artificial Intelligence and Data Science
- Computer Science and Engineering(Cyber Security)

20.2 The eligibility for choosing the minor degree is given as below:

Sl. No.	Minor Degree	Eligible Major Degree Programmes (from other Departments)
1.	Artificial Intelligence and Machine Learning	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering
2.	BLOCKCHAIN	
3.	Cyber Security	
4.	Data Science	
5.	Internet of Things (IoT)	
6.	Virtual and Augmented Reality	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering
8.	Robotics	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology

		Electrical and Electronics Engineering Electronics and Instrumentation Engineering
9.	3D Printing	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
10.	Electric Vehicles	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology Electronics and Communication Engineering
11.	Industrial Automation	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electronics and Communication Engineering
12.	GIS and Remote Sensing	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology

		Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
13.	Computational Biology	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Electrical and Electronics EngineeringElectronics and Instrumentation Engineering Electronics and Communication Engineering

20.3 A student shall earn an additional 18 to 20 credits for the award of a minor degree.

20.4 A student shall be awarded a minor degree only when he / she completes the requirements for the award of major degree stipulated in the respective programme.

21.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. COMPUTER SCIENCE AND ENGINEERING

CURRICULUM & SYLLABI, REGULATIONS 2021

(Choice Based Credit System)

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BSC	PHD 1182	Engineering Physics *	3	0	2	4
2.	BSC	CHD 1182	Chemistry for Electrical and Electronic Engineering *	3	0	2	4
3.	BSC	MAD 1181	Algebra and Differential Calculus	3	1	0	4
4.	ESC	GED 1101	Engineering Graphics	2	0	2	3
5.	ESC	GED 1102	Engineering Design	2	0	0	2
6.	ESC	GED 1103	Manufacturing Practice Laboratory**	0	0	2	1
7.	ESC	GED 1104	Programming for Problem Solving **	1	0	2	2
			Credits				**20#**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	END 1281	English for Engineers	3	0	0	3
2.	BSC		Physics Elective	2	0	0	2
3.	BSC		Chemistry Elective	2	0	0	2
4.	BSC	MAD 1281	Advanced Calculus	3	1	0	4
5.	ESC	GED 1201	Engineering Mechanics	3	1	0	4
6.	ESC	GED 1202	Basic Electrical and Electronics Engineering*	3	0	2	4
7.	PCC	CSD 1201	Object Oriented Programming *	2	0	2	3
8.	MC	GED 1206	Environmental Sciences	2	0	0	2
			Credits				**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC		Humanities Elective I	3	0	0	3
2.	BSC		Mathematics Elective	3	1	0	4
3.	PCC	CSD 2101	Python Programming	3	0	0	3
4.	PCC	CSD 2102	Digital Systems *	3	0	2	4
5.	PCC	CSD 2103	Data Structures	3	0	0	3
6.	PCC	CSD 2104	Software Engineering	3	0	0	3
7.	PCC	CSD 2105	Python Programming Laboratory **	0	0	2	1
8.	PCC	CSD 2106	Data Structures Laboratory **	0	0	2	1
9.	HSC	GED 2101	Essential Skills and Aptitude for Engineers**	0	0	2	1
			Credits				**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	CSD 2201	Computer Communication and Networks	3	0	0	3
2.	PCC	CSD 2202	Analysis of Algorithms	3	0	0	3
3.	PCC	CSD 2203	Computer Architecture and Microprocessor	3	0	0	3
4.	PCC	CSD 2204	Operating Systems *	3	0	2	4
5.	PCC	CSD 2205	Database Management Systems	3	0	0	3
6.	PEC		Professional Elective Courses	3	0	0	3
7.	PCC	CSD 2206	Computer Communication and Networks Laboratory **	0	0	2	1
8.	PCC	CSD 2207	Database Management Systems Laboratory **	0	0	2	1
9.	MC	GED 2202	Indian Constitution and Human Rights	2	0	0	0
10.	HSC	GED 2201	Workplace Skills and Aptitude for Engineers**	0	0	2	1
			Credits				**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	CSD 3101	Theory of Computation	3	0	0	3
2.	PCC	CSD 3102	Artificial Intelligence Techniques	3	0	0	3
3.	PCC	CSD 3103	Network Security and Cryptography *	3	0	2	4
4.	PCC	CSD 3104	Data Mining and Data Warehousing	3	0	0	3
5.	PEC		Professional Elective Courses				6
6.	PCC	CSD 3105	Internet and Web Programming Laboratory **	0	0	2	1
7.	PCC	CSD 3106	Artificial Intelligence and Machine Learning Laboratory **	0	0	2	1
8.	PROJ	CSD 3107	Internship I ##	0	0	0	1
9.	HSC	GED 3101	Communication Skills For Career Success**	0	0	2	1
			Credits				**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	MSD 3281	Entrepreneurship	3	0	0	3
2.	HSC		Humanities Elective II	2	0	0	2
3.	OEC		Open Elective I	3	0	0	3
4.	PCC	CSD 3201	Big Data and Cloud Computing	3	0	2	4
5.	PCC	CSD 3202	Compiler Design	3	0	0	3
6.	PEC		Professional Elective Courses				6
7.	PCC	CSD 3203	Compiler Laboratory **	0	0	2	1
8.	PCC	CSD 3204	Mobile Application Development Laboratory **	0	0	2	1
9.	HSC	GED 3201	Reasoning and Aptitude for Engineers**	0	0	2	1
			Credits				**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	OEC		Open Elective II				3
2.	OEC		Open Elective III				3
3.	PCC	CSD 4101	BLOCKCHAIN Technology	3	0	0	3
4.	PEC		Professional Elective Courses				12
5.	PROJ	CSD 4102	Internship II###				1
6.	HSC	GED 4101	Employability Skills$	0	0	2	1
			Credits				**22**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PROJ	CSD 4201	Project Work	0	0	18	9
			Credits				**9**

Overall Total Credits – 167

* Laboratory Integrated Theory course

** Laboratory Course

Three Week Orientation Programme – Mandatory Non-Credit Course

15 days of Industrial training during the summer vacation of second year. The credit will be awarded in the 5th Semester.

###15 days of Industrial training during the summer vacation of third year. The credit will be awarded in the 7th Semester.

$Not a Mandatory Course - The student will take up this course during the Summer Holidays of III year as a comprehension of Soft Skills courses offered from semester III to VI. Upon successful completion, the course will be mentioned in grade sheet of VII semester.

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^ As approved by BOS of CSE held on 17.08.2023

LIST OF PROFESSIONAL ELECTIVE COURSES

SPECIALIZATION I: COMPUTER NETWORKS AND SECURITY

SEMESTER – IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PEC	CSDX 201	Digital Transmission	3	0	0	3
2.	PEC	CSDX 202	Cellular and Wireless Networks	3	0	0	3
3.	PEC	CSDX 203	Design of Computer Network Services	3	0	0	3

SEMESTER – V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PEC	CSDX 101	Queuing Theory	3	0	0	3
2.	PEC	CSDX 102	Distributed Computing	3	0	0	3
3.	PEC	CSDX 103	Cyber Laws and Ethics	3	0	0	3
4.	PEC	CSDX 104	Virtualization Techniques	3	0	0	3

SEMESTER – VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PEC	CSDX 221	Routing Protocols	3	0	0	3
2.	PEC	CSDX 222	Intrusion Detection and Prevention	3	0	0	3
3.	PEC	CSDX 223	Internet of Things	3	0	0	3
4.	PEC	CSDX 224	Secure Interconnecting Systems	3	0	0	3

SEMESTER – VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PEC	CSDX 121	Graph Theory and its Applications	3	0	0	3
2.	PEC	CSDX 122	Quantum Computing	3	0	0	3
3.	PEC	CSDX 123	Green Computing	3	0	0	3
4.	PEC	CSDX 124	Security Evaluation and Assessment Methodology	3	0	0	3
5.	PEC	CSDX 125	5G Wireless Communication Techniques	3	0	0	3

SPECIALIZATION II:INTERNET PROGRAMMING AND SERVICES

SEMESTER – IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 204	Scripting Languages	3	0	0	3
2	PEC	CSDX 205	Information Retrieval	3	0	0	3

SEMESTER – V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 105	XML and Web services	3	0	0	3
2	PEC	CSDX 106	Open-Source Technologies	3	0	0	3

SEMESTER – VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 225	Full Stack Mobile Application Development I (Front end)	3	0	0	3
2	PEC	CSDX 226	Web Analytics and Social Media Mining	3	0	0	3
3	PEC	CSDX 227	Cloud Security	3	0	0	3

SEMESTER – VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 126	Full Stack Mobile Application Development II (Back end)	3	0	0	3
2	PEC	CSDX 127	Web Hacking and Security	3	0	0	3
3	PEC	CSDX 128	Social Media Security	3	0	0	3

SPECIALIZATION III: COMPUTER GRAPHICS AND MULTIMEDIA

SEMESTER – IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 206	Multimedia Design program	3	0	0	3
2	PEC	CSDX 207	Sound Editing and Processing	3	0	0	3
3	PEC	CSDX 208	Multimedia Application Development.	3	0	0	3

SEMESTER – V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 107	Image processing	3	0	0	3
2	PEC	CSDX 108	Computer Vision	3	0	0	3

SEMESTER – VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 228	Advanced Computer Graphics	3	0	0	3
2	PEC	CSDX 229	Human Computer Interaction	3	0	0	3
3	PEC	CSDX 230	User Interface Design	3	0	0	3

SEMESTER – VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 129	Multimedia Security	3	0	0	3
2	PEC	CSDX 130	Multimedia Communication and Networking	3	0	0	3
3	PEC	CSDX 131	API Design	3	0	0	3
4	PEC	CSDX 132	AAIP – Animation with Portfolio Development	3	0	0	3
5	PEC	CSDX 133	Mobile Multimedia Systems	3	0	0	3

SPECIALIZATION IV: SOFTWARE ENGINEERING

SEMESTER – IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 209	Software Design and Architecture	3	0	0	3
2	PEC	CSDX 210	Software Configuration and Risk Management	3	0	0	3

SEMESTER – V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 109	Software Metrics and Testing	3	0	0	3
2	PEC	CSDX 110	Software Requirements and Modeling	3	0	0	3

SEMESTER – VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 231	Software Quality Assurance	3	0	0	3
2	PEC	CSDX 232	Software Integration and Maintenance	3	0	0	3

SEMESTER – VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 134	Software Project Management	3	0	0	3
2	PEC	CSDX 135	Enterprise Resource Planning	3	0	0	3

SPECIALIZATION V: COMPUTER ARCHITECTURE AND APPLICATION ORIENTED COURSES

SEMESTER – IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 211	Information Ethics and Visualization	3	0	0	3
2	PEC	CSDX 212	C# and .NET	3	0	0	3

SEMESTER – V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 111	Foundation on Robotics	3	0	0	3
2	PEC	CSDX 112	Statistics and Analytics using R Programming	3	0	0	3
3	PEC	CSDX 113	Essentials of Data Science	3	0	0	3

SEMESTER – VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 233	Gaming Technology	3	0	0	3
2	PEC	CSDX 234	Cognitive Science	3	0	0	3
3	PEC	CSDX 235	High Performance Computer Architecture	3	0	0	3
4	PEC	CSDX 236	Natural Language Processing	3	0	0	3
5	PEC	CSDX 237	Multicore Architecture	3	0	0	3
6	PEC	CSDX 238	Service Oriented Architecture	3	0	0	3

SEMESTER – VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PEC	CSDX 136	Programming in Data Science with Python	3	0	0	3
2	PEC	CSDX 137	Genetic Algorithm	3	0	0	3
3	PEC	CSDX 138	Advanced SAS: Macros & SQL	3	0	0	3
4	PEC	CSDX 139	Microservices Architecture (DevOps and Kubernetes)	3	0	0	3
5	PEC	CSDX 140	Advanced Game Design	3	0	0	3
6	PEC	CSDX 141	Dockers and Containers	3	0	0	3
7	PEC	CSDX 142	AI Chat Bot Application	3	0	0	3

PHYSICS ELECTIVES – II Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	PHDX 01	Non Destructive Testing of Materials	2	0	0	2
2	PHDX 02	Materials Science for Engineering	2	0	0	2
3	PHDX 03	Biomaterials	2	0	0	2
4	PHDX 04	Optical Fibre Communication	2	0	0	2
5	PHDX 05	Semiconductor Physics for Information Technology	2	0	0	2
6	PHDX 06	Sensors and Actuators	2	0	0	2
7	PHDX 07	Fundamentals of Nanotechnology and its Applications	2	0	0	2

CHEMISTRY ELECTIVES – II Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	CHDX 01	Chemistry of Construction Materials	2	0	0	2
2	CHDX 02	Chemistry of Materials and Electrochemical Devices	2	0	0	2
3	CHDX 03	Chemistry and Instrumentation for Electrical and Electronic Applications	2	0	0	2
4	CHDX 04	Functional Materials and Applications	2	0	0	2
5	CHDX 05	Chemistry of Fuels, Combustion and Lubricants	2	0	0	2
6	CHDX 06	Instrumental Methods of Polymer Analysis	2	0	0	2
7	CHDX 07	Medicinal Chemistry	2	0	0	2

MATHEMATICS ELECTIVES – III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	MADX 01	Transforms and Partial Differential Equations	3	1	0	4
2	MADX 02	Discrete Mathematics	3	1	0	4
3	MADX 03	Probablity and Statistics	3	1	0	4
4	MADX 04	Random Processes	3	1	0	4
5	MADX 05	Numerical Methods	3	1	0	4

HUMANITIES ELECTIVES – III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 01	Engineering Economics and Management	3	0	0	3
2	SSDX 02	Sociology of Science and Technology	3	0	0	3
3	SSDX 03	Industrial Economics and Management	3	0	0	3

4	SSDX 04	Dynamics of Indian Social Structure	3	0	0	3

HUMANITIES ELECTIVES – VI Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 11	Economics of Sustainable Development	2	0	0	2
2	SSDX 12	Sociology of Industrial Relations.	2	0	0	2
3	SSDX 13	Professional Ethics and Human Values	2	0	0	2
4	SSDX 14	Gender, Technology and Development	2	0	0	2

OPEN ELECTIVE COURSES FOR
B.TECH. PROGRAMMES R 2021 - VI SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1	GEDX 201	Application of Fluid Mechanics in Everyday Life	3	0	0	3	Aero
2	GEDX 202	Basics of Management and Organizational Behaviour	3	0	0	3	CSB
3	GEDX 203	Big Data Analytics	3	0	0	3	CA
4	GEDX 204	Biology for Engineers	3	0	0	3	SLS
5	GEDX 205	Consumer Electronics	3	0	0	3	ECE
6	GEDX 206	Creative Writing	2	1	0	3	English
7	GEDX 207	Cyber Forensics	3	0	0	3	CSE
8	GEDX 208	Cyber Security	3	0	0	3	IT
9	GEDX 209	Disaster Management	3	0	0	3	Civil
10	GEDX 210	English for Competitive Examination	2	1	0	3	English
11	GEDX 211	Enterprise Risk Management	3	0	0	3	CSB
12	GEDX 212	Fundamentals of Project Management	3	0	0	3	CSB
13	GEDX 213	Industrial Robotics*	2	0	2	3	Mech.
14	GEDX 214	Internet of Things and its Applications	3	0	0	3	ECE
15	GEDX 215	Introduction to Health Care Analytics	3	0	0	3	CA
16	GEDX 216	IPR and Patent Laws	3	0	0	3	CSB
17	GEDX 217	Logistics and Supply Chain Management	3	0	0	3	CSB
18	GEDX 218	Nano Materials and Technology*	2	0	2	3	Physics / Chemistry
19	GEDX 219	Numerical Computational Tools for Engineers*	2	0	2	3	EIE
20	GEDX 220	Optimization Techniques	3	0	0	3	EEE
21	GEDX 221	Polymers for Emerging Technologies	3	0	0	3	Polymer
22	GEDX 222	Programming Language Principles	3	0	0	3	CSE

23	GEDX 223	Public Speaking and Rhetoric	2	1	0	3	English
24	GEDX 224	Python Programming*	2	0	2	3	IT
25	GEDX 225	R Programming	3	0	0	3	CA
26	GEDX 226	Smart Sensors for Healthcare Applications	3	0	0	3	EIE
27	GEDX 227	Total Quality Management	3	0	0	3	Mech.
28	GEDX 228	Value Education	3	0	0	3	Commerce
29	GEDX 229	Waste Water Management	3	0	0	3	Civil
30	GEDX 230	Web Application Development	3	0	0	3	CA

OPEN ELECTIVE COURSES FOR B.TECH. PROGRAMMES R 2021 - VII SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1	GEDX 101	Advanced Entrepreneurship	3	0	0	3	CSB
2	GEDX 102	Artificial Intelligence and Machine Learning Applications	3	0	0	3	CSE
3	GEDX 103	Automotive Technology	3	0	0	3	Automobile
4	GEDX 104	Behavioural Psychology	3	0	0	3	SSSH
5	GEDX 105	Building Repair Solutions	3	0	0	3	Civil
6	GEDX 106	Cloud Services and Management	3	0	0	3	CA
7	GEDX 107	Cost Management for Engineers	3	0	0	3	Commerce
8	GEDX 108	Cyber Law and Ethics	3	0	0	3	CSL
9	GEDX 109	Data Analytics and Visualization	3	0	0	3	CA
10	GEDX 110	Deep learning Essentials	3	0	0	3	CSE
11	GEDX 111	Drone Technologies*	2	0	2	3	Aero
12	GEDX 112	Electric Vehicle	3	0	0	3	EEE
13	GEDX 113	Emerging Technologies in Mobile Networks	3	0	0	3	ECE
14	GEDX 114	Fundamentals of Data Science and Machine Learning	3	0	0	3	IT
15	GEDX 115	Genetic Engineering	3	0	0	3	SLS

16	GEDX 116	Green Design and Sustainability	3	0	0	3	Civil
17	GEDX 117	Image Processing and its Applications	3	0	0	3	ECE
18	GEDX 118	Industrial Automation and Control	3	0	0	3	EIE
19	GEDX 119	Industrial Safety	3	0	0	3	Mech.
20	GEDX 120	Industry 4.0	3	0	0	3	Mech.
21	GEDX 121	Introduction to Artificial Intelligence	3	0	0	3	IT
22	GEDX 122	Introduction to Artificial Intelligence and Evolutionary Computing	3	0	0	3	EEE
23	GEDX 123	Motor Vehicle Act and Loss Assessment	3	0	0	3	Automobile
24	GEDX 124	National Service Scheme	3	0	0	3	SSSH
25	GEDX 125	National Cadet Corps	3	0	0	3	SSSH
26	GEDX 126	Personal Finance and Investment	3	0	0	3	Commerce
27	GEDX 127	Soft Computing Techniques	3	0	0	3	CSE
28	GEDX 128	Value Analysis and Engineering	3	0	0	3	Mech.
29	GEDX 129	Vehicle Maintenance	3	0	0	3	Automobile

PHD 1182	ENGINEERING PHYSICS	L	T	P	C
SDG: 4		3	0	2	4

COURSE OBJECTIVES:

COB1: To equip the students on the knowledge of electromagnetic waves.

COB2: To make the students in understanding the importance of mechanics.

COB3: To introduce the basics of oscillations, optics and lasers.

COB4: To acquire basic knowledge about the principle and theory of solids.

COB5: To understand the importance of physics behind semiconductor devices.

MODULE I ELECTROMAGNETIC WAVES 9

Gauss's law – Faraday's law - Ampere's law–Properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Reflection and transmission of electromagnetic waves from a non-conducting medium.

MODULE II QUANTUM MECHANICS 9

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh-Jean's law– Matter waves–Physical significance of wave function – Schrodinger wave equation – Time independent and time-dependent wave equation – Applications: Particle in one-dimensional box – Introduction to quantum computing.

MODULE III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - Anti-reflection coating - Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet-Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: Nd:YAG laser He-Ne laser and semiconductor laser - Applications : Laser Materials Processing - Holography.

MODULE IV INTRODUCTION TO SOLIDS 9

Free electron theory of metals- Expression for electrical conductivity of metal-Fermi level-Fermi distribution function-Effect of Fermi function with temperature-Density of energy states-carrier concentration in metals-Effect of temperature on Fermi energy- Energy distribution of electrons- Work function of a metal-Electron in a periodic potential (Kronig and Penny model)-Brillouin Zones-Fermi surface-Effective mass of electron and hole-Energy bands in solids.

MODULE V PHYSICS OF SEMICONDUCTORS 9

Elemental and compound semiconductors –Direct and Indirect band gap semiconductors- Drift and diffusion current – Intrinsic semiconductors: Intrinsic carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

PRACTICALS

List of Experiments

1. Determination of thickness of a thin wire / sheet using Air Wedge method.
2. Determination of wavelength of laser light using semiconductor laser diffraction.
3. Determination of angle of divergence of a laser beam using semiconductor diode laser and He-Ne laser.
4. Resistivity measurement of a semiconductor using four-point probe method.
5. Determination of band gap of a semiconductor diode.
6. Determination of Hall coefficient of a given semiconductor material.
7. Determination of frequency of a tuning fork using Melde's string arrangement in transverse and longitudinal modes.
8. Determination of particle size of lycopodium powder using semiconductor laser.

L – 45; P – 30 ; Total Hours – 75

TEXT BOOKS:

1. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
2. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCES:

1.D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015.
2.Serway R.A. and Jewett, J.W., Physics for Scientists and Engineers with Modern Physics, Brooks/cole Publishing Co., 2010.
3.Tipler P.A. and Mosca, G.P., Physics for Scientists and Engineers with Modern Physics, W.H. Freeman, 2007.
4.Markert J.T., Ohanian. H. and Ohanian, M., Physics for Engineers and Scientists, W.W. Norton & Co., 2007.
5.Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.
6.Linear Integrated Circuits by D. Roy Choudhury and Shail Jain - New Age International (P) Ltd.(2003).
7.Integrated Electronics by J.Millman and C.Halkias, Tata McGraw Hill, New Delhi (2001).

COURSE OUTCOMES:

CO1: Express the knowledge of electromagnetic waves.

CO2: Comprehend the importance &principles of quantum mechanics andapply it to understand ideas of quantum computing.

CO3: Grasp ideas related to oscillations, interference phenomenon, apply it to understandoptical based devices and classify the different laser systems used forvarious applications.

CO4: Conceptualize the electron theory of metals and band structure of solids.

CO5: Understand the principles of physics behind semiconductors, Hall effectand apply the same to identify type of any semiconductor sample, evaluateno. of charge carriers.

Board of Studies (BoS) :	**Academic Council:**
BOS of Physics was held on 21.06.21	17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	L	L	M	M	M	L	L	L	M	M			
CO2	H	M	M	L	L	M	L	L	L	L	L	M			
CO3	H	M	M	L	L	L	L	L	L	L	L	M			
CO4	H	M	M	L	M	M	M	L	L	L	M	M			
CO5	H	M	M	L	M	M	M	L	L	L	M	M			

Note: L- Low Correlation M -Medium CorrelationH -High Correlation

SDG 4:Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CHD 1182	**CHEMISTRY FOR ELECTRICAL AND**	**L**	**T**	**P**	**C**
SDG: 9	**ELECTRONIC ENGINEERING**	**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

To make the students conversant with

COB1: preparation, properties and applications of polymers and moulding techniques.

COB2: synthesis, properties and applications of nanomaterials

COB3: classification and description of different types of batteries and their applications.

COB4: concepts of photochemistry related to photophysical processes, chemical reactions and its applications.

COB5: types of corrosion and its prevention.

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **10**

Classification: source, heat, composition – glass transition temperature – preparation, properties and applications of polyethene (LDPE, HDPE), poly(vinyl chloride), PMMA, polycarbonate, teflon, ABS, bakelite, urea-formaldehyde, epoxy resin - conducting polymers: polyaniline, polyacetylene and poly(phenylene vinylene), rubber- vulcanised rubber, ebonite, EPDM, polymer blends and alloys - moulding techniques: injection moulding, compression moulding.

MODULE II NANOMATERIALS **10**

Introduction – classification based on dimension with examples – properties of nanomaterials (surface to volume ratio and size quantisation effect) - synthesis of nanomaterials (Top-down and Bottom-up)– role of capping & reducing agents - CVD (CNT), laser ablation (Ag, Ag_2O), electrodeposition (semiconductor materials), precipitation (Ag, Au), thermolysis: solvothermal (CuO, CeO_2) and hydrothermal (TiO_2, ZnO, carbon dots), microwave method (metal oxide), biogenic method – nanocomposite.

MODULE III BATTERIES **8**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cell, alkaline battery – secondary batteries: nickel cadmium cell – lead acid storage cell - lithium battery: primary and secondary type - PN junction solar cell, thin film solar cell.

MODULE IV PHOTOCHEMISTRY 9

Introduction: absorption and emission – laws of photochemistry: Grotthus-Draper law, Stark Einstein law – quantum efficiency – determination of quantum yield (problems) – Jablonski diagram: photo physical processes – IC, ISC, fluorescence and phosphorescence –(electronic states and transitions) – quenching – chemiluminescence – bioluminescence – photosensitization: principle and applications(photosynthesis and artificial photosynthesis) – photoelectrolysis.

MODULE V CORROSION AND ITS PREVENTION 8

Types of corrosion – dry and wet corrosion – galvanic corrosion – differential aeration corrosion – Prevention of corrosion: choice of materials, electroplating, electrolesss plating of PCB, coatings : paints: constituents and function – hot dipping – galvanizing, tinning – powder coating – anodising – special coatings: water repellent coatings, fire-retardant coatings, temperature indicating coatings.

PRACTICALS

1. Free radical polymerization of PMMA.
2. Preparation of phenol-formaldehyde.
3. Preparation of urea-formaldehyde.
4. Synthesis of epoxy resin.
5. Determination of molecular weight and degree of polymerisation of polyvinyl alcohol using viscometer
6. Electrochemical synthesis of graphene oxide
7. Synthesis of nano-ZnO by precipitation
8. Demonstration of Laser ablation techniques for nanomaterials
9. Construction of dry cell and alkaline battery
10. Measurement of EMF for different batteries.
11. Electroplating of copper
12. Determination of corrosion of mild steel in acidic, neutral and basic medium.

L –45; P – 30;Total Hours –75

TEXT BOOKS:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2016.

REFERENCES:

1. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1986.

2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
4. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

COURSE OUTCOMES:

The students will be able to

CO1: summarise the preparation, properties and applications of plastics used in electrical and electronic applications

CO2: synthesize different types of nanomaterials based on its size and applications.

CO3: illustrate construction and working of various types of batteries with the aid of a diagram.

CO4: state laws of photochemistry and elaborate the various types of photophysical processes and concepts of photochemistry.

CO5: explain the different types of corrosion and elaborate the methods of various coating techniques.

Board of Studies (BoS) : 11th BoS of Chemistry held on 17.06.2021

Academic Council: 15th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1		H		M					L						
CO2		H		M					L						
CO3		H													
CO4		M													
CO5		M	M			L	L								

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Industry, Innovation & Infrastructure

Statement: The synthesis and use of polymers and nanomaterials supports the industrial growth and innovation activities of the nation. The aspects of corrosion and its prevention will lead to corrosion free environment in the industry and infrastructure.

MAD1181	ALGEBRA AND DIFFERENTIAL CALCULUS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To introduce matrix algebra techniques for engineers to apply in practical problems

COB2: To find the roots of polynomial equations using different techniques

COB3: To demonstrate the concepts of limits, continuity and application of differential calculus.

COB4: To familiarize the students with the functions of several variables

COB5: To develop the use of differential equations necessary for engineering applications

MODULE I MATRICES 9+3

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation

MODULE II THEORY OF EQUATIONS 9+3

Introduction - Surds and irrational roots – simple problems – Equations whose roots are in A.P,G.P and in H.P – Relations between the roots and coefficients – symmetric functions – Formation of equations – Decreasing and Increasing the roots – transformation of equation – Reciprocal equations

MODULE III DIFFERENTIAL CALCULUS 9+3

Limits of functions - one sided limits – Continuity - Curvature – Cartesian and polar coordinates – center and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

Laws of limits –Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor's series expansion – Optima of two variables – Lagrange's multiplier method

MODULE V ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients –

homogeneous equations of Euler's type – method of undetermined coefficients- method of variation of parameters

L –45;T- 15;Total Hours – 60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2010.
2. Grewal B.S., "Higher Engineering Mathematics" 44th edition, Khanna Publishers, New Delhi, 2017.
3. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Jain, R.K. & Iyengar, S. R. K., "Advanced Engineering Mathematics", Narosa Publishers, 5th edition, 2016.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
5. James Stewart ," Calculus" 7th edition, Brooks/Cole Cengagelearning, UK

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:use the matrix algebra methods for finding eigenvalues, eigenvectors and diagonalization

CO2: solve equations using the relations between roots and coefficients

CO3: apply differential calculus in various engineering problems

CO4: able to use differential calculus on several variable functions

CO5: solve various types of differential equations that arise in many applications

Board of Studies (BoS) :
12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	M														
CO2	M														
CO3	H														
CO4	M														
CO5	M														

SDG 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like matrices and calculus will lead to knowledge of applications in Computer Science.

GED 1101	ENGINEERING GRAPHICS	L	T	P	C
SDG: 9		2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the basic concepts of engineering drawing, andfamiliarize with conic sections, special curves and orthographic projection of points and straight lines.

COB2: To get practical exposure on projection of planes and solids.

COB3: To be familiar with sectioning of solids, and development of surfaces.

COB4: To conversant with 3D isometric projection, and perspectiveprojection of simple solids.

COB5: To introduce computerized drafting using CADD for drawing theorthographic views of simple solids.

MODULE I BASICS, ENGINEERING CURVES AND ORTHOGRAPHIC PROJECTION OF POINTS AND STRAIGHT LINES **L: 7 P: 7**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola. Special curves: cycloid, epicycloid, hypocycloid and involutes.

Orthographic projection – first angle, second angle, third angle and fourth angle projections. Orthographic projection of points in all quadrants. Projection of straight lines in first quadrant – true length and true inclinations –traces of straight line.

MODULE II PROJECTION OF PLANES AND SOLIDS **L: 7 P: 7**

Projection of plane lamina in first quadrant and its traces

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, and cylinder – change of position method

MODULE III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **L:5 P:5**

Section of solids: prism, pyramid, cone and cylinder– sectional view – true shape of section- cutting simple position solids - plane inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone and cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE IV THREE DIMENSIONAL PROJECTIONS L:4 P: 4

Isometric projection: Isometric scale – isometric axes- Isometric projection and view of prism, pyramid, cylinder, cone and frustums.

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid by Visual ray method.

MODULE V ORTHOGRAPHIC PROJECTION USING CADD L:7 P:7

Introduction to CADD - Basic commands for sketching - Editing sketches - creating texts and tables - Basic dimensioning and editing dimensions - Sketching orthographic views of simple solids and machine parts as per first angle projection - Plotting drawings.

L – 30;P – 30;Total Hours – 60

TEXT BOOKS:

1. N.D. Bhatt, “Engineering Drawing”,Charotar Publishing house, 53rdEdtion, 2014.
2. Venugopal. K, and V. Prabhu Raja, “Engineering Graphics”, New Age International (P) Ltd., Publication, Chennai, Edition 15, 2017.

REFERENCES:

1. K.V. Natarajan, “A text book of Engineering Graphics”, Dhanalakshmi publishers, Chennai, 31st Edition, 2018.
2. Agrawal B. & Agrawal C. M., “Engineering Graphics”, TMH Publication, 2012.
3. Jeyapoovan, T., “Engineering Graphics using AutoCAD”, Vikas Publishing House Pvt. Ltd., New Delhi, 2015.
4. AutoCAD Software Theory and User Manuals
5. Engineering graphics You tube Lecture videos link: https://www.youtube.com/user/BSAUNIV/videos

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: identify the specifications and standards of technical drawing and drawconic sections, special curves and orthographic projection of points andstraight lines

CO2: apply the concept of orthographic projection to draw the orthographic views of plane figures and simple solids

CO3:draw the sections of solids and development of solid surfaces

CO4: apply the concept of isometric and perspective projection to draw the 3-D views of simple solids

CO5: draw the orthographic views of simple objects using drafting software

Board of Studies (BoS):
18thBoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO2	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO3	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO4	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO5	M	L	L	-	M	-	-	-	-	L	-	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The various industrial standards of technical drawing and the application of orthographic projections to draw simple solids helps to innovate a new design for sustainable industrialization

GED 1102	ENGINEERING DESIGN	L	T	P	C
SDG:9		2	0	0	2

COURSE OBJECTIVES:

COB1: To learn the basic concepts of design in engineering

COB2: To study the basic design thinking principles in problem solving

COB3: To encourage the students to develop a prototype using design concepts

COB4: To introduce the role of innovation in engineering

MODULE I INTRODUCTION TO DESIGN 08

Introduction to Engineering design – Design thinking – Problem identification - Design of Product, Process, System and Software – Case studies on Product, Process, Systems and Software design.

MODULE II DESIGN THINKING PROCESS 08

Empathy – Ideate - Need analysis - Voice of customers - product specification - concept generation - Bench marking - Quality function deployment - Concept evaluation - Case studies

MODULE III PROTOTYPE DESIGN 07

Product form and function – High level design – Design detailing - Sketch models – Prototypes - 3D printing - Case studies.

MODULE IV INNOVATION 07

Creativity and innovation – Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – Intellectual property rights - case studies on innovative products.

L – 30;Total Hours – 30

TEXT BOOKS:

1. Clive L. Dym, Patrick Little, and Elizabeth J. Orwin, “Engineering Design: A Project Based Introduction”, 4th Edition, Wiley, 2014.
2. Eppinger, S. and Ulrich, K., “Product design and development”, McGraw-Hill Higher Education, 2015.

REFERENCES:

1. Nigel Cross, “Design Thinking”, Berg Publishers, 2011.
2. Tom Kelley, “The Art of Innovation”, Profile Books Ltd, London, 2016.

3. Tim Brown, “Change by Design”, HarperCollins e-books, 2009.
4. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: explain the basic concepts of design in engineering products / process / Service

CO2:analyse the problems and perform design thinking process

CO3: correlate the basic principles of design thinking to solve engineering problems and develop prototypes

CO4: apply innovative approaches to engineering problems and provide design solutions

Board of Studies (BoS):
18th BoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	-	H	-	M	-	-	-	-	L	-	L	-	-
CO4	-	-	M	-	-	-	-	-	-	L	-	L	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of basic knowledge in Engineering design and its process in the development of prototypes results in satisfying industrial challenges.

GED 1103	MANUFACTURING PRACTICES	L	T	P	C
SDG: 9	LABORATORY	0	0	2	1

COURSE OBJECTIVES:

COB1: To learn the basics of pipe connections used in household andindustrial systems

COB2: To educate the usage of welding equipment's and machiningmethods

COB3: To impart knowledge onsand mould preparation for simple components

COB4: To explorevarious tools, instruments and methods used in electrical wiring

COB5: To impart knowledge onDesign, assembly and testing of electronic circuits

PRACTICALS

List of Experiments:

CIVIL ENGINEERING PRACTICE:

1. Study of plumbing in general household and industrial systems: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
2. Making a small window frame with Lap and Mortise & Tenon Joints by sawing planing and cutting.
3. Introduction to power tools

ECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints using Arc Welding - Gas cutting (Demo)
2. Machining of a component using simple turning and drilling practices.
3. Foundry operations such as sand mold preparation for simple component.
4. Plastic Component Manufacturing (Demo on Injection / Blow moulding)

ELECTRICAL ENGINEERING PRACTICE:

1. Comparison of incandescent, fluorescent, CFL and LED lamps.
2. Domestic, staircase and go down wiring.
3. Measurement of earth resistance.
4. Study of protection devices (small relay, fuse, MCB, HRC, MCCB, ECCB).
5. Familiarization of household electrical gadgets (Iron Box, Wet Grinder).

6. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE:

1. Identifications and symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Design and testing of electronic circuits using active and passive electronic components

P – 30;Total Hours –30

TEXT BOOK:

1. S.Gowri and T.Jeyapoovan, “Engineering Practices Lab Manual – Civil, Mechanical, Electrical, Electronics included”, Vikas Publishing, 5th Edition, 2019.

REFERENCES:

1. SubhransuSekhar Dash &K.Vijayakumar, “Electrical Engineering Practice Lab Manual”, Vijay Nicole Imprints Private Ltd., First Edition, 2013.
2. Raghbir Singh Khandpur, “Printed Circuit Boards: Design, Fabrication, and Assembly”, Tata McGraw-Hill Education, 2005.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: demonstrate Plumbing requirements of domestic buildings.

CO2: use welding equipment’s to join the structures and to carry out machining operations

CO3: perform the task of making sand mould for simple components

CO4: execute simple electrical wiring and comprehend the construction and working of household appliances.

CO5: assemble and test simple electronic circuits used in day-to-day life

Board of Studies (BoS):
18thBoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-

CO2	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	L	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of welding, moulding, machining, wiring andelectronic circuit increases the access of small-scale industrial and otherenterprises in developing countries.

GED 1104	**PROGRAMMING FOR**	**L**	**T**	**P**	**C**
SDG: 8	**PROBLEM SOLVING**	**1**	**0**	**2**	**2**

COURSE OBJECTIVES:

COB1: To explore the hardware and software components of thecomputer

COB2: To learn the structured and procedural programming concepts usingC.

COB3: To study the constructs of decision making in branching and iteration statements

COB4: To learn Functions for effective reusability and readability of the code.

COB5: To understand pointer and file operation concepts.

MODULE I **INTRODUCTION TO C PROGRAMMING** **05**

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, system software, compilers, creating, compiling and executing a program, Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming - Structure of C - C Tokens – Data Types – Declaration of Variables and Storage class – Operators – Expressions - Type Conversion.

MODULE II **DECISION MAKING AND ARRAY** **05**

Decision Making and Branching: Simple if Statements, The if..else statements, Nesting of if..else statements, else…if Ladder, switch Statements, goto Statements, Looping: while, do…while, for Statements, Array: One-Dimensional, Two-Dimensional and Multi-Dimensional operations.

MODULE III **USER-DEFINED FUNCTIONS AND FILE OPERATIONS** **05**

Definition of Functions - Function Types – Nesting of Functions – Recursion – Structures and Unions – Pointers - File handing operations.

PRACTICALS

LIST OF PROGRAMS IN C:

1. Computer organization –Hardware in a typical computer Identification – Booting error messages and what it means
2. Structure of a basic program - Hello world program
3. Data types and Type conversions
4. Input / Output: Formatted functions – Unformatted functions – Library functions
5. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
6. Conditional Statements: If – if else- nested if else- goto- switch case – nested switch case
7. Iteration Statements: for loops – nested for loops – while loop – do-while loop – break and continue statement
8. I/O operations of one- and two-dimensional arrays
9. Bubble Sort and Linear Search using arrays.
10. Functions and its types, Recursion Function
11. Pointers File Operations

L – 15; P – 30;Total Hours – 45

TEXT BOOKS:

1. Richard L. Stegman, “Focus on Fundamentals of Programming with C”, Ninth Edition, ISBN -170077395X, 9781700773951, 2019.
2. E.Balagurusamy, “Programming in ANSI C”, McGraw Hill Education, Eighth Edition, ISBN-13: 978-93-5316-513-0, ISBN-10: 93-5316-513-X, 2019.

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, “ The C Programming Language”, Prentice Hall, ISBN 0-13-110362-8, 2015.
2. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012.
3. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: identify the hardware components and describe the software components of computer.

CO2: bring out the importance of structural and procedural programming

CO3: write C coding using conditional and iteration statements

CO4: develop programs using Functions, Pointers and Files
CO5: implement program to build a real time application.

Board of Studies (BoS) :
18th BoS of CSE held on 26.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M	M	L	H	-		-	L	M	-	-	-	-	M
CO2	H	M	M	M-	-			L	M	-	-	-	-	M
CO3	H	M	H	M-	-			-L	H	-	-	-	-	L
CO4	H	H	H	H	M			-L	H	-	-	-	-	L
CO5	H	H	H	H	H			L	H	L	H	H	-	L

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning this computer fundamentals and programming course.

SEMESTER II

END 1281	**ENGLISH FOR ENGINEERS**	**L**	**T**	**P**	**C**
SDG: 4		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To train students to use appropriate vocabulary in academic and technical contexts

COB2: To facilitate students to speak effectively while exchanging ideas and making presentations

COB3: To develop students' listening skill for comprehending and analysing information

COB4: To develop their reading skill through sub skills like skimming, scanning and critical reading of a text

COB5: To sharpen their academic writing skills

COB6: To expose them to the correct usage of language and help them to apply that knowledge appropriately

MODULE I HUMAN RESOURCES 10

L: Listening to short texts – short formal & informal conversations.

S: Introducing one self – exchanging personal info.

R: Process of reading purposes, Reading comprehension, improving comprehension skills, Reading activities – short comprehension passages, practice in skimming & scanning.

W: Scientific & Technical Writing, Editing skills, Activities – completing sentences, developing hints - Paragraph Writing

Voc. development: Prefixes, Suffixes

Lang. development: Articles, Countable and Uncountable nouns, Present tense, Wh– Questions, Yes or No questions.

MODULE II TRANSPORT 10

L: Listening to long scientific talks

S: Sharing personal information – greeting, leave taking.

R: Comprehension passages with multiple choice questions / Wh–questions/ openended questions - Reading longer technical texts & completing exercises based on them.

W: Use of reference words & discourse markers on a text, jumbled sentences, describing a process – flow chart, use of sequence words.

Voc. development: Guessing meanings of words in context, vocabulary used in formal letters, e-mails & reports.

Lang. development: Preposition of Time, Place & Date, Past tense, Conjunctions, Impersonal passive voice, Question tags, Numerical Adjectives.

MODULE III ENERGY 9

L:Listening to talk on the topic & completing tasks.

S: Asking about routine actions & expressing opinions.

R: Locating Specific Information

W: Letter seeking permission for Industrial Visit / symposium – Letter of invitation

Voc. development: Sequence words, misspelt words.

Lang. development: Adverbs, Degrees of comparison, Future tense, Homophones

MODULE IV OUR LIVING ENVIRONMENT 8

L: Listening to scientific texts & making notes – Effective ways of making notes.

S: Speaking about one's friend.

R: Reading texts & magazines for detailed comprehension. (Students can be asked to read any book of their choice to encourage reading habit)

W: Argumentative writing.

Voc. Development: Synonyms, antonyms, phrasal verbs.

Lang. development: If clauses, Subject - Verb Agreement

MODULE V TECHNOLOGY 8

L: Listening to talks (General & Scientific).

S: Short group conversations.

R: Reading and understanding technical articles, Short narratives & articles from Newspaper including conversations.

W: Short essays, Dialogue writing.

Voc. Development: Idioms & Phrases.

Lang. development: Modal verbs.

L - 45;Total Hours -45

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1. Perry, Carol Rosenblum(2011). The Fine Art of Technical Writing, Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan G. andPrakash, C.L.N. (2007). A course in Communication Skills, Cambridge Univesity Press, India.
3. Sen, Leena(2004). Communication Skills, Prentice Hall, New Delhi.
4. Matt Firth, Chris Sowton et.al (2012). Academic English An Integrated Skills Course for EAP, Cambridge University Press, Cambridge.
5. Bailey,Stephen2011. Academic Writing: A practical guide for students, New York, Rutledge.
6. Redston, Chris&Gillies (2005). Cunningham Face2Face (Pre-intermediate Student's Book&Workbook) Cambridge University Press, New Delhi.
7. Dutt P. Kiranmai and RajeevanGeeta (2013). Basic Communication Skills, Foundation Books.

COURSE OUTCOMES:

CO1: Read articles of a general kind in magazines and newspapers

CO2:Participate effectively in conversations, introduce themselves and their friends and express opinions in English

CO3: Comprehend conversations and short talks delivered in English

CO4: Write short essays of a general kind and letters and emails in English

CO5: Express through speaking and writing using appropriate vocabulary and grammar

Board of Studies (BoS) :
13thBoS of Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1	-	-	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	-	-	-	-	-	-	H	-	-
CO3	-	-	-	-	-	-	-	-	-	M	-	-
CO4	-	-	-	-	-	-	-	-	-	H	-	-
CO5	-	-	-	-	-	-	-	-	-	M	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Give Quality Education to all the Engineers

Statement: In future, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

MAD1281	ADVANCED CALCULUS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To acquaint **i**n the students in solving problems using multiple integrals

COB2: To acquire knowledge in vector calculus which is significantly used in engineering problems

COB3: Tolearn about the analytic functions and their mapping properties

COB4: To know complex integration using Cauchy's theorems.

COB5: To introduce techniques and engineering applications of Laplace Transforms

MODULE I MULTIPLE INTEGRATION 9+3

Multiple integrals– Cartesian and Polar coordinates – Change of order of integration – Beta and Gamma functions – Properties and applications-Multiple integrals to compute area and volume

MODULE II VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields–Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals

MODULE III COMPLEX DIFFERENTIATION 9+3

Analytic function - Necessary and Sufficient condition for analyticity – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation

MODULE IV COMPLEX INTEGRATION 9+3

Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis)

MODULE V LAPLACE TRANSFORMS 9+3

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave:

Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

L – 45;T-15;Total Hours – 60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2010.
2. Grewal B.S., "Higher Engineering Mathematics" 44th edition, Khanna Publishers, New Delhi, 2017.
3. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011.

REFERENCES:

1.Jain, R.K. & Iyengar, S. R. K., "Advanced Engineering Mathematics", Narosa Publishers, 5th edition, 2016.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
4. James Stewart ," Calculus" 7th edition, Brooks/Cole Cengagelearning, UK

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: compute the area and volume using multiple integrals

CO2: calculate vector identities and apply Gauss, Stokes and Greens theorems to simplify calculations of integrals

CO3: verify analyticity, conformity and bilinearity of complex functions

CO4: evaluate integrals using the Cauchy's integral and formula and residue theorem

CO5: solve ordinary differential equations using Laplace transforms

Board of Studies (BoS) :
12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3

CO1	M														
CO2	M														
CO3	H														
CO4	M														
CO5	M														

SDG 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like Integration and Vector Calculus will lead to knowledge of applications in Computer Science

GED 1201	ENGINEERING MECHANICS	L	T	P	C
SDG: 9		3	1	0	4

COURSE OBJECTIVES:

COB1: To impart knowledge about the basic laws of mechanics,resolution of forces, equilibrium of particles in 2D and 3D force systems.

COB2: To learn about supports, reactions and equilibrium of rigidbodies

COB3: To educate surface properties such as centroid and momentof inertia

COB4: To impart knowledge on friction and its applications

COB5: To study the laws of motion, impulse, momentum and elasticbodies

MODULE I VECTOR APPROACH AND EQUILIBRIUM OF PARTICLE **L: 11 T: 3**

Introduction - Vectors – Vectorial representation of forces and moments – Vector Algebra and its Physical relevance in Mechanics – Laws of Mechanics – Parallelogram and triangular Law of forces- Coplanar Forces Principle of transmissibility, Resolution and Composition of forces- Forces in plane and space - Lame's theorem - Equilibrium of a particle in 2D plane - Equilibrium of a particle in 3D space - Equivalent systems of forces – Single equivalent force

MODULE II EQUILIBRIUM OF RIGID BODY **L: 7 T: 3**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Examples

MODULE III PROPERTIES OF SURFACES **L:10 T:3**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section using standard formula – second and product moments of plane area – Physical relevance - Standard sections: Rectangle, triangle, circle-composite sections, Hollow section using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia

MODULE IV FRICTION **L:9 T:3**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction –Block friction– Rolling resistance –ladder friction and wedge friction

MODULE V LAWS OF MOTION **L:8**

T:3

Review of laws of motion – Newton's second law – D'Alembert's principle and its applications in plane motion; Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45;T – 15; Total Hours – 60

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers", McGraw Hill Education, 10th Edition, 2017.
2. R.K. Bansal., "A Text Book of Engineering Mechanics", Laxmi Publications, 6th Edition, 2015.

REFERENCES:

1. Russell C Hibbeler, "Engineering Mechanics: Statics & Dynamics", 14th Edition, Pearson, 2015.
2. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education India, 2005.
3. R.S. Khurmi., "A Text Book of Engineering Mechanics", S. Chand Publishing, 22nd Edition, 2018.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: resolve composite forces, apply concept of equilibrium to particles and solve problems

CO2: apply the concept of equilibrium to rigid bodies and solve problems

CO3: determine the properties of surfaces

CO4: analyse and evaluate the frictional forces between the bodies

CO5: apply the laws of motion in solving dynamics problems

Board of Studies (BoS):
18th BOS held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	M	-	-	-
CO3	-	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	L	-	-	-	-	-

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The understanding of force systems and its components leads to construction of robust engineeringsystems.

		L	T	P	C
GED 1202	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**				
SDG: 3, 5, 8, 12		**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

COB1: To make the students understand the basic calculations and measurements in DC circuits.

COB2: To provide the basic knowledge on AC circuit calculations and measurements.

COB3: To familiarize with working and characteristics of different DC and AC machines.

COB4: To impart knowledge onbasic semiconductor devices and their applications.

COB5: To introduce the students to fundamentals of digital electronics.

MODULE I DC CIRCUITS & MEASUREMENTS 12

The concept of voltage and current -Electric circuit elements: R, L, C – Independent and dependent sources - Ohm's law- Kirchhoff's law- series and parallel resistive circuits – Voltage and current division – Star-delta transformation - Mesh and nodal analysis of resistive circuits – simple problems - Measurement ofvoltage, current and power in DC circuits.

MODULE II AC CIRCUITS & MEASUREMENTS 17

Sinusoidal voltage - RMS, average, peak value, peak factor and form factor - single phase RL, RC and RLC circuits –phasor representation - complex power – power factor - simple problems - Resonance in RLC circuits – 3 phase balanced circuit calculations– star and delta connections - Principles of measurement of AC voltage, current, power and energy - Measurement of three phase power.

MODULE III ELECTRICAL MACHINES 18

Construction, principle of operation, basic equations, characteristics and applications of DC generators, DC motors, single phase transformers and three phase induction motors. Working principle of BLDC Motor and its applications in home appliances.

(Qualitative treatment only).

MODULE IV SEMICONDUCTOR DEVICES AND APPLICATIONS 14

Introduction to semiconductors - Characteristics of PN Junction Diode – Zener Diode and its characteristics – SCR and its characteristics — Bipolar

Junction Transistorand its characteristics – JFET & MOSFET – their characteristics.

Applications: Half wave and full wave rectifiers - Voltage Regulation – Regulator ICs.

MODULE V INTRODUCTION TO DIGITAL CIRCUITS 14

Logic gates- Boolean algebra theorems– K Map-Introduction to combinational circuits– Flip-Flops – Registers– A/D and D/AConversion – Data acquisition systems

PRACTICALS

List of Experiments

1. Verification of KCL and KVL (ii) Measurement of voltage, current and power in DC circuits.
2. (i) Resonance of RLC series circuit
   (ii) Measurement of voltage, current, power and power factor in single phase & three phase AC circuits.
3. (i) Magnetization characteristics of DC generator
   (ii) Characteristics of DC shunt motor, single phase transformer and three phase induction motor.
4. Fabrication of a low voltage regulated power supply.
5. Implementation of half and full adders.

L – 45; P – 30; Total Hours – 75

REFERENCES:

1. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 12th Edition, 2016.
2. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Education, First Edition, 2017.
3. Cotton H, “Electrical Technology”, CBS Publishers, 7th Edition, 2007.
4. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2015.
5. Jacob Millman & Christos C. Halkias, Satyaprataba Jit “Electronic Devices and Circuits” McGraw Hill Education, 4th Edition, 2021.
6. Floyd, “Electronic Devices: Conventional Current Version” Pearson Education India, 7th Edition, 2008.
7. S. Salivahanan, N. Sureshkumar and A. Vallavaraj, “Electronic Devices and Circuits”, McGraw Hill Education (India) Pvt. Ltd., 2018.

8. Thomas L. Floyd, "Digital Fundamentals", 10th Edition Pearson Education Inc., New Delhi, 2008.

COURSE OUTCOMES:

At the end of this course, the student will be able to:

CO1: perform the basic calculations in DC circuits and measure the various quantities associated with DC circuits.

CO2: measure and compute the rms current and voltage, power, power factor and energy in AC circuits.

CO3: choose appropriate motor for specific applications based on the motor characteristics.

CO4: fabricate a regulated power supply for low voltage applications and build static switches using BJT and SCR.

CO5: build simple digital circuits like half adder and full adder.

Board of Studies (BoS) :
15th meeting of BoS of EEE held on 25.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H	-	H	L	M	-	M	-	L	L	M	L	H	M	NA
CO2	H	-	H	L	M	-	M	-	L	L	M	L	H	M	NA
CO3	H	-	H	L	-	-	M	-	L	L	M	L	-	M	NA
CO4	H	-	H	L	-	-	M	-	L	L	M	L	L	M	NA
CO5	H	-	H	L	-	-	M	-	L	L	M	L	-	M	NA

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 3: Good health and well being.

Statement: Understanding of the fundamentals of electrical and electronics systems can help in designing systems to promote good health and well being.

SDG 5: Gender equality

Statement: Acquiring the interdisciplinary knowledge help overcome the gender barriers in work place.

SDG 8: Descent work and economic

Statement: The learners of this course can get descent work and earn financial benefits and they can work in interdisciplinary areas.

SDG 12: Responsible consumption and production.

Statement: Use of right and energy efficient electric and electronic components and devices results is reasonable consumption and production.

CSD 1201	OBJECT ORIENTED PROGRAMMING	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the concepts of Object-Oriented Programming (OOP). Procedures or methods that perform operations on the data.

COB2: To provide knowledge on Classes, Objects and scope resolution operator.

COB3: To learn syntax constructs of C++ and Java to implement basic Object-Oriented Programs

COB4: To explore the Packages, Multithreading and Exception handling concepts of Java

COB5: To expose Object Oriented Programming for developing real time applications

MODULE I BASICS OF OBJECT-ORIENTED PROGRAMMING C++ 10

Concepts of OOPS – Derived Data Types – Scope Resolution Operator – Functions – Classes and Objects –abstract class - Inheritance - Polymorphism.

MODULE II JAVA LANGUAGE 10

Introduction – Data Types - Operators – Classes, Objects and Methods - Arrays, Strings, Vector.

MODULE III PROGRAMMING USING INTERFACES 10

Inheritance – Packages – Multithread Programming – Errors and Exceptions

PRACTICALS

SOFTWARE REQUIRED: C++ and JAVA

Design problems and implement solutions for the following concepts:

1. Classes and Objects
2. Constructor and Destructor
3. Overloading and Overriding
4. Types of Inheritance
5. Friend Function
6. Virtual Function and Dynamic binding
7. File handling and Exception handling

8. Friend Function
9. Virtual Function and Dynamic binding
10. File handling and Exception handling
11. Basic Java programs
12. Inheritance in Java
13. Packages and Multithreading in Java

L – 30;P- 30;Total Hours – 60

REFERENCES:

1. Balagurusamy, “OOPS using C++ and JAVA”, Tata McGraw-Hill Education, ISBN 9781259051371, 2018.
2. Graham M. Seed, “An Introduction to Object-Oriented Programming in C++”, Springer, ISBN:9781447133780, 2012
3. M. T. Somashekara, D. S. Guru, K. S. Manjunatha, “Object Oriented Programming with Java”, Prentice Hall India Pvt., Limited, ISBN:9788120352872, 2017.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1: Apply OOPs basic concepts to implement C++ and Java programs

CO2: Implement the concepts of abstract class and polymorphism in programs.

CO3: Employ C++ and Java programs using different inheritance methods.

CO4: Demonstrate the use of various OOPs concepts with the help of programs

CO5: Propose Object Oriented Programming for real time applications.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	M	M	L	-	-	L	M	L	M	L	H	H
CO2	H	H	H	M	L	-	-	L	M	L	M	L	H	H
CO3	H	H	H	M	L	-	-	L	M	L	M	L	H	
CO4	H	H	L	L	L	-	-	L	M	H	H	L	M	H
CO5	H	H	M	L	L	-	-	L	M	H	H	L	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning the Object-Oriented Programming course.

GED 1206	ENVIRONMENTAL SCIENCES	L	T	P	C
SDG: All		2	0	0	2

COURSE OBJECTIVES:

To make the student conversant with the

COB1: various natural resources, availability, utilisation and its current scenario.

COB2: diverse ecosystems and its function, importance of biodiversity, its values, threats and conservation.

COB3: types of pollutants and its impacts on the environment and the effects of natural disasters.

COB4: impacts of human population, human health, diseases and immunisation for a sustainable lifestyle.

MODULE I NATURAL RESOURCES 8

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems - (a) Land resources: Land degradation soil erosion and desertification - (b) Forest resources: Use and over-exploitation, deforestation (c) Water resources: Use and over-utilisation of surface and ground water, conflicts over water, dams: benefits and problems, effects on forest and tribal people - (d) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, mining (e) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture (f) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources.

MODULE II ECOSYSTEMS AND BIODIVERSITY 8

Concept of an ecosystem - Food chains, food webs, Energy flow in the ecosystem - ecological pyramids - Ecological succession - Characteristic features, structure and function of (a) Terrestrial Ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem (b) Aquatic fresh water ecosystems: Ponds and lakes, rivers and streams (c) Aquatic salt water ecosystems: oceans and estuaries Biodiversity and its conservation - Types: genetic, species and ecosystem diversity - Values of biodiversity - India as a mega-diversity nation - Invasive, endangered, endemic and extinct species - Hot sports of biodiversity and Red Data book - Threats to biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 8

Sources, cause, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear pollution (h) ill-effects of fireworks and upkeep of clean environment, types of fire and fire extinguishers- Solid waste Management: types, collection, processing and disposal of urban waste, industrial waste, e-waste and biomedical wastes - Disaster management: flood, drought, cyclone, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Human Population - Population growth, Population explosion, population pyramid among nations - Family Welfare Programme - Human Rights - Value Education - Environment and human health: air-borne, water borne, infectious diseases, contagious diseases and immunisation (all types of vaccines from birth), risks due to chemicals in food and water, endocrine disrupting chemicals, cancer and environment - Sustainable development - Resettlement and rehabilitation of people - Environment Legislative laws- Women and Child Welfare, Public awareness.

Case studies related to current situation.

L – 30;Total Hours - 30

TEXT BOOKS:

1. Erach Bharucha, “Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education for University Grants Commission”, Orient Blackswan Pvt. Ltd., Hyderabad, India, 2013.
2. Benny Joseph, “Environmental Studies”, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, “Environmental Science and Engineering”, Sri Krishna Publications, Tamil Nadu, India, 2018.
4. Raman Sivakumar, “Introduction to Environmental Science and Engineering”, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, “Principles of Environmental Science and Engineering”, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., “Environmental Science and Engineering”, New Age International Pvt. Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., “Introduction to Environmental Engineering and Science”, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., “Environmental Science and Engineering”, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., “Environmental Science”, Wadsworth Publishing Co. Boston, USA, 2016.
4. “Waste to Resources: A Waste Management Handbook”, The Energy and Resources Institute, 2014.
5. https://www.teriin.org/article/e-waste-management-india-challenges-and-opportunities.
6. https://green.harvard.edu/tools-resources/how/6-ways-minimize-your-e-waste.
7. https://www.aiims.edu/en/departments-and-centers/central-facilities/265-biomedical/7346-bio-medical-waste-management.html.
8. https://tspcb.cgg.gov.in/Shared%20Documents/Guidelines%20for%20Management%20of%20Healthcare%20Waste%20Waste%20Management%20Rules,%202016%20by%20Health%20Care%20Facilities.pdf.

COURSE OUTCOMES:

The student will be able to

CO1: analyse the current scenario of various natural resources and their depletion and suggest remedies to curb the exploitation.

CO2: identify food chains and web and its function in the environment, assess the impacts on the biodiversity and propose solutions to conserve it.

CO3: analyse the types and impacts of pollutants in the environment and propose suitable methods to alleviate the pollutants and the natural disasters.

CO4: assess on the impact of human population and the health related issues and immunisation practices and sustainable developments for a healthy life.

Board of Studies (BoS) :
11th BoS of Chem held on 17.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	-	L	M	-	-	L	M	-	-	-	-	-	-	-	-
CO 2	-	-	-	M	H	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	M	M	-	-	L	-	M	-	-
CO 4	-	-	-	-	-	M	M	M	-	-	-	L	-	-	-
CO 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG All: No Poverty, Zero Hunger, Good Health and Well-Being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable & Clean Energy, Decent Work and Economic Growth, Industry, Innovation & Infrastructure, Reduced Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace, Justice and Strong Institutions, Partnerships for the Goals.

Statement: This course discuss about the environment, all the natural resources available, sharing of resources, effective utilisation, effects of over utilisation, health and environmental issues pertained to that, global warming and related issues, climates, disasters, impact assessments, population, human rights, societal welfare, laws to conserve the environment and sustainability.

SEMESTER III

CSD 2101	PYTHON PROGRAMMING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To expose the fundamentals of python programming.

COB2: To discover the need to work with control structures in Python programming.

COB3: To learn the objects, classes, and other object-oriented features

COB4: To study the process of structuring data using lists, dictionaries, tuples and sets.

COB5: To explore file operations and file handling techniques.

MODULE I INTRODUCTION 9

Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators – Values and Types – Statements - Operators – Boolean Values – Operator Precedence – Expression.

MODULE II CONTROL STRUCTURE AND FUNCTION 9

Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

MODULE III PYTHON DATA STRUCTURE 9

List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – Mutability – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets --Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary.

MODULE IV CLASS AND OBJECTS 9

Abstract Data Types – Classes – Inheritance – Multiple level of Inheritance – Substitution Principles – Encapsulation and Information Hiding- Python Standard Libraries–Packages

MODULE V FILE HANDLING AND EXCEPTION HANDLING 9

Introduction to Files – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

L –45;TOTAL HOURS –45

TEXT BOOKS:

1. Paul J. Deitel and Harvey Deitel," Python for Programmers", First edition, Pearson Education, ISBN-10 : 9353947987, 2020.
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press, ISBN-10 9390457157, 2021.

REFERENCES:

1. John V. Guttag, "Introduction to Computation and Programming Using Python: with Application to Understanding Data", 2nd edition, MIT Press, ISBN-13: 978-0262529624, 2016.
2. Bill Lubanovic, "Introducing Python: Modern Computing in Simple Package", O'Reilly Media, 1st edition, ISBN-13: 9781449359362, 2014.
3. Reema Thareja," Python Programming: Using Problem Solving Approach", Oxford University Press, 1st edition**,** ISBN-10: 0199480176, 2019.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Explore the fundamentals of python programming.

CO2: Discover the need to work with control structures in Python programming.

CO3:Learn objects, classes, and other object-oriented features.

CO4: Illustrate the process of structuring data using lists, dictionaries, tuples and sets.

CO5: Develop the ability to build real time applications.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	L	L	H	-	-	L	L	L	H	H	H	H
CO2	H	H	L	L	H	-	-	L	L	L	M	H	M	M
CO3	M	H	L	L	M	-	-	L	L	L	M	H	M	M
CO4	H	M	H	H	M	-	-	L	L	L	H	M	H	H
CO5	H	H	M	M	M	-	-	L	L	L	M	M	H	H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning the concepts of python program, the students are ableto apply the concepts to design real time application, which can improve productive employment.

CSD 2102	DIGITAL SYSTEMS	L	T	P	C
SDG: 9		3	0	2	4

COURSE OBJECTIVES:

COB1: To explore Boolean algebra, Boolean functions and realization of functions with basic gates.

COB2: To design combinational and sequential circuits.

COB3: To use the concepts of state and state transition for analysis and design of sequential circuits.

COB4: To study and investigate the sequential networks using counters and shift registers.

COB5: To learn Hardware Design Language programming for digital Systems.

MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 9

Binary Number Systems - Binary Arithmetic - Binary Codes - Boolean Algebra and Theorems -Boolean functions- Canonical and Standard forms - Logic operations-Logic Gates - Gate Level Minimization - K-Map method- Product of sums simplification - Don't care conditions- NAND and NOR implementation - Other two level implementation –Exclusive OR function - Hardware Description Language.

MODULE II COMBINATIONAL LOGIC 9

Combinational circuits - Analysis and Design procedures -Adder, Subtractor- Decimal adder – Binary Multiplier - Magnitude Comparators -Encoder -Decoder - Multiplexer - Demultiplexer - HDL models of combinational circuits.

MODULE III SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential Circuits - Latches and Flip Flops - Analysis of clocked sequential circuits– State Table, State Reduction Diagram and State Assignment – Design Procedure.

MODULE IV REGISTERS AND COUNTERS 9

Registers-Shift Registers -Ripple Counters - Synchronous Counters-Other Counters-HDL for Registers and Counters –Programmable Logic Array- Programmable Array Logic- Sequential Programmable Devices.

MODULE V MEMORIES AND REGISTER TRANSFER LOGIC 9

Memory Unit-Examples of Random-Access Memories- Arithmetic, Logic and Shift Micro operations-Conditional Control Statements-Fixed point Binary Data-Arithmetic Shifts-Decimal Data-Floating-point Data-Nonnumeric Data-Instruction Codes-Design Simple Computer.

PRACTICAL

1. Verification of the truth tables of TTL gates.
2. Verify the NAND and NOR gates as universal logic gates.
3. Design and verification of the truth tables of Half and Full adder circuits.
4. Design and verification of the truth tables of Half and Full subtractor circuits.
5. Verification of the truth table of the Multiplexer 74150
6. Verification of the truth table of the De-Multiplexer 74154.
7. Design and test of an S-R flip-flop using NOR/NAND gates.
8. Verify the truth table of a J-K flip-flop (7476)
9. Verify the truth table of a D flip-flop (7474)
10. Operate the counters 7490, 7493.
11. Design of 4-bit shift register (shift right).
12. Design of modulo-4 counter using J K flip-flop.

L – 45; P - 30; TOTAL HOURS – 75

TEXT BOOKS:

1. Anil K. Maini," Digital Electronics: Principles and Integrated Circuits", Wiley, ISBN-10:8126508639,2019.
2. Chinmoy Saha , "Basic Electronics: Principles and Applications", Cambridge University Press, 1st edition, ISBN-13:9781316632932,2018.

TEXT BOOKS AND REFERENCES:

1 S K Mandal, "Digital Electronics: Principles and Applications", McGraw Hill Education, 1st edition, ISBN-10: 0070153825, 2017.
2 Kumar A. Anand, "Fundamentals of Digital Circuits", PHI, 4th edition, ISBN: 8120352688, 2016.
3 M. Morris Mano and Michael D. Ciletti,"Digital Design | With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson Education, 6th edition, ISBN-10:9353062012, 2018.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Understand the fundamental concepts of Boolean algebra and logic gates.

CO2: Analyze and design combinational circuits

CO3: Design sequential circuits containing latch and flip-flops.

CO4: Evaluate the concepts of state and state transition for analysis and design of sequential circuits.

CO5: Implement digital logic circuits using logic gates.

Board of Studies (BoS) :

22nd BoS of CSE held on 17.08.2023

Academic Council:

21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	H	M	M			L	L			L	M	M
CO2	H	H	H	M	M			L	L			L	M	M
CO3	H	H	H	M	M			L	L	L	L	L	M	M
CO4	H	H	H	H	M			L	L	L	L	L	M	M
CO5	H	H	H	H	M			L	L	L	M	L	L	H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning the concepts of digital systems, the students are ableto apply the concepts to build real time projects which can add to productive employment.

CSD 2103	DATA STRUCTURES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the importance of data structures in developing and implementing efficient algorithms.

COB2: To design and implementation of various basic and advanced data structures

COB3: To employ the different data structures to find the solutions for specific problems

COB4: To explore the different types of searching and sorting algorithms.

COB5: To develop application-using data structures.

MODULE I OVERVIEW, ARRAYS, RECORDS AND POINTERS 9

Introduction – Basic Terminology- Data Structures – Algorithms – Linear Arrays – Representation of linear arrays in Memory – Traversing linear arrays – Searching – Multidimensional arrays – Pointers – Records.

MODULE II LINKED LIST 9

Linked list – Representation of linked list in Memory – Traversing a Linked List – Searching a Linked List – Memory allocation – Insertion into a Linked list – Deletion from a Linked List – Header Linked Lists – Two- ways Lists.

MODULE III STACKS, QUEUES AND RECURSION 9

Stacks – Array Representation of Stacks-Linked Representation of Stacks – Arithmetic Expressions – Application of stacks – Recursion – Towers of Hanoi – Implementation of Recursive procedures by Stacks – Queues – Linked representation of Queues – Dequeues – Priority Queues.

MODULE IV NON-LINEAR DATA STRUCTURE 9

Binary Trees – Representing Binary Trees in Memory – Binary Tree Traversal – Binary Search Trees – AVL Search Trees –m-way search trees – B trees – Heap–Heap sort– Huffman's Algorithms – Graph Theory Terminology – Graph Representation – Warshall's Algorithm – Operations on a Graph – Traversing a Graph – Topological Sorting.

MODULE V SORTING AND SEARCHING 9

Sorting – Insertion Sort – Selection Sort – Merging – Merge Sort – Radix Sort – Searching and Data modification – Hashing

L – 45;TOTAL HOURS – 45

TEXT BOOKS:

1. Yashavant Kanetkar," Data Structures Through C", BPB, ISBN-13:978-9388511391,2019.
2. R.S. Salaria, "Data Structures & Algorithms Using C",Khanna Publishing, 5th edition, ISBN-13:978-9381068588, 2018.

REFERENCES:

1 G. A. V. Pai, "Data Structures and Algorithms: Concepts, Techniques and Applications", McGraw Hill Education, 1st edition, ISBN-10: 0070667268, 2017.
2 NarasimhaKarumanchi," Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, 5thEdition, ISBN-13: 978-8193245279, 2016.
3 ReemaThareja, "Data Structures Using C", Oxford Publisher, 2nd edition, ISBN-13: 978-0198099307, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Apply the different linear data structures like stack and queue to various computing problems.

CO2: Analyze the design choices onthe data structure performance

CO3: Develop applications using various data structures.

CO4: Recommend suitable data structure for a given real time problem.

CO5: Evaluate and choose appropriate design technique.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	L	L	H	-	-	L	L	L	H	H	H	H
CO2	H	M	M	M	L	-	-	L	L	-	L	L	H	M
CO3	H	H	L	L	H	-	-	L	L	L	H	H	H	H
CO4	H	M	H	H	M	-	-	L	L	L	H	M	M	H
CO5	H	M	M	M	M	-	-	L	L	L	M	M	H	M

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning the concepts of Data Structures, the students are ableto apply the data structures to solve real time problems which can improve the productive employment.

CSD 2104	SOFTWARE ENGINEERING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the process involved in software development.

COB2: To learn the importance of requirements gathering.

COB3: To understand theneed of design phase to build a software prototype.

COB4: To provide knowledge to develop quality software in a systematic method.

COB5: To explore the various testing methodologies.

MODULE I SOFTWARE PROCESS 9

Nature of Software – Software Engineering - Software Process – Models – Generic Process Model – Process Assessment - Prescriptive Process Model – Specialized Process Models – Unified Process – Personal and Team Process Models – Process Technology – Product and Process – Agile Model.

MODULE II REQUIREMENTS GATHERING 8

Requirements Engineering – Understanding Requirements – Requirements Modeling – Scenarios, Information and Analysis Classes, Flow, Behavior, Patterns and Web Apps.

MODULE III DESIGN 9

Introduction – Design Process – Design Concepts – Design Model – Software Architecture – Component Based Development, Introduction – User Interface Design – Pattern Based Design – WebApp Design.

MODULE IV QUALITY MANAGEMENT 9

Software Quality – Achieving Software Quality – Review Techniques – SQA Goals and Metrics – Software Reliability.

MODULE V SOFTWARE TESTING AND MAINTENANCE 10

Software Testing – Strategic Approach – Issues – Test Strategies – Validation Testing – System Testing – Debugging – Testing Fundamentals: Path Testing, White Box and Black Box, Control Structure – Testing Applications. Software Maintenance – Supportability – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Risk Management.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Roger S. Pressman, “Software Engineering – A Practitioners Approach”, Mc Graw Hill, Eighth Edition, ISBN -13: 9789339212087, 2014.
2. Charles G.Cobb,”The Project Manager's Guide to Mastering Agile: Principles and Practices for an Adaptive Approach”, Wiley, ISBN: 978-1-118-99104- 6, 2015.
3. Ian Sommerville, “Software Engineering”, Addison-Wesley, 9th Edition, ISBN-13: 978-0137035151, 2010.

REFERENCES:

1. Vaclav Rajlich, “Software Engineering: The Current Practice”, CRC Press, ISBN-13: 978-1439841228, 2012.
2. Jibitesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, ISBN 978-81-317-5869-4, 2012.
3. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, ISBN: 9780070265127, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: choose the appropriate process model for the software application to be developed.

CO2: collect requirements based on the type of the application and its need.

CO3: design frameworks for the application to be developed

CO4: ensure that the software satisfies the quality standards

CO5: apply the appropriate testing strategies to the developed products.

Board of Studies (BoS) :

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M	M	M	L			L	H	L	M	L	M	M
CO2	H	M	M	M				L	H	L	M	L	M	M
CO3	H	M	H	M	M			L	H	L	M	L	H	M
CO4	H	H	M	M				L	H	L	M	L	M	M
CO5	H	H	H	H	M			L	H	L	H	L	H	H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement : To develop and disseminate efficient and effective methods for the development of quality software for complex and critical systems. It is addressed through the focus on software targeting industrial sectors enhancing scientific research and innovation.

CSD 2105	PYTHON PROGRAMMING	L	T	P	C
SDG: 9	LABORATORY	0	0	2	1

COURSE OBJECTIVES:

COB1: To learn the representation of conditional statements and loops in Python programming.

COB2: To explore the purpose of regular expression in building the Python programs

COB3: To understand the syntax of functions and recursive functions..

COB4: To gain programming knowledge on Python lists, tuples, dictionaries.

COB5: To expose basic functionalities of file operations..

PRACTICALS

List of Experiments:

1. Find the maximum of a list of numbers.
2. Python program that accepts a string and calculate the number of digits and letters.
3. Python program to iterate over dictionaries using for loops.
4. Python function to check whether a number is perfect or not.
5. Python function to calculate the factorial of a number (a non-negative integer).
6. Python program to solve the Fibonacci sequence using recursion.
7. Find the most frequent words in a text read from a file.
8. Given a pair of positive integers a and b (a < b; 0 < m < 9; 1 < n < = 10), write a program to smartly affix zeroes, while printing the numbers from a to b.
9. Harry went to a movie with his friends in a and during break time he bought pizzas, puffs and cool drinks. Consider the following prices :

   Rs.100/pizza

   Rs.20/puffs

   Rs.10/cooldrink

   Generate a bill for What Harry has bought.
10. Rajesh wants to design a board, which displays a character for a corresponding number for his science project. For example, when the digits 65,66,67,68 are entered, the alphabet ABCD are to be displayed.Help him to develop such an application.
11. Akash planned to choose a four digit lucky number for his car. His lucky numbers are 3,5 and 7. Help him find the number, whose sum is divisible by 3 or 5 or 7. Provide a valid car number, Fails to provide a valid input then display that number is not a valid car number.

12. Raj wants to know the maximum marks scored by him in each semester. He has completed 3 semesters (5 subjects in each semester).The mark should be between 0 to 100 ,if goes beyond the range display “You have entered invalid mark.”

P – 30; TOTAL HOURS –30

TEXT BOOKS:

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press, ISBN-10 9390457157, 2021.

REFERENCES:

1. Paul J. Deitel,” Python for Programmers”, First edition, Pearson Education, ISBN-10 :9353947987 ,2020.
2. ReemaThareja,” Python Programming: Using Problem Solving Approach”, Oxford University Press**,** ISBN-10:0199480176, 2017.
3. John V. Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, MIT Press, ISBN: 978-0262529624, 2016.

PLATFORM NEEDED :Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Interpret the use of conditional statements, loops and function calls.

CO2: Write the simple programs using regular expression.

CO3: Demonstrate the concept of functions and recursive functions.

CO4: Represent data using Python lists, tuples, dictionaries.

CO5: Implement the use of file system in Python.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	L	L		-	-	L	H	-	H	L	H	-
CO2	H	L	L					L	H	M	H	L	M	-
CO3	H	M	L	L	M			L	H	L	H	L	M	H
CO4	H	M	H	H				L	L	-	L	L	H	-
CO5	M	M	H	H	L			L	L	-	L	L	H	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement :By learning Python Programming, the students can be able to solve any real time problem which in turn can improve employment.

CSD 2106	DATA STRUCTURES LABORATORY	L	T	P	C
SDG: 9		0	0	2	1

COURSE OBJECTIVES:

COB1: To make familiar with the data structure concepts.

COB2: To implement the Stack and Queue ADT.

COB3: To traverse the tree and graph data structures.

COB4: To implement searching and sorting techniques.

COB5: To demonstrate the shortest path algorithm.

PRACTICALS

List of Experiments:

Design problems and implement solutions for the following concepts:

1. Basic data structure concepts
2. Linked list
3. Stack ADT
4. Queue ADT
5. Priority Queue
6. Sorting and Searching
7. Tree traversal
8. Tree Structure - Binary tree
9. AVL tree
10. Shortest path algorithm

P –30; TOTAL HOURS –30

TEXT BOOKS:

1. Seymour Lipschutz, “Data Structures”, McGraw Hill Education, Revised First edition, ISBN-10: 1259029964, ISBN-13: 978-1259029967, 2014.

REFERENCES:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Pearson Education; Second edition, ISBN-10: 9332535841,ISBN-13: 978- 9332535848, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Implement appropriate data structure to solve problems.

CO2: Illustrate stack and queue operations.

CO3: Examine sorting and searching algorithms using relevant data structures.
CO4: Understand the implication of tree and graph data structure in solving complex problems.
CO5: Analyse the algorithm for the shortest path.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	H	M	M	L	-	-	L	H	-	H	L	H	-
CO2	H	M	L	M				L	H	M	H	L	M	-
CO3	H	M	M	M	M			L	H	L	H	L	M	H
CO4	M	M	H	H				L	L	-	L	L	H	-
CO5	M	M	H	H	L			L	L	-	L	L	H	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement :
The course provides deep knowledge on data structures and provides solutions for industrial applications using various algorithms.

GED 2101	ESSENTIAL SKILLS AND APTITUDE	L	T	P	C
SDG: 17	FOR ENGINEERS	0	0	2	1

COURSE OBJECTIVES:

COB1:To enable them to make effective business presentations

COB2:To train them to participate in group discussions

COB3: To enhance the problem-solving skills

COB4: To train students in solving analytical problems

MODULE I ORAL DISCOURSE 07

Importance of oral communication-verbal and non-verbal communication, Presentation Strategies- one minute presentation (using Audacity/vocaro) - Effective listening skills, listening for specific information

MODULE II VERBAL COMMUNICATION 08

Understanding negotiation, persuasion & marketing skills - Listening to short conversations & monologues - Group Discussion techniques - Role plays - Interview techniques

MODULE III BASIC NUMERACY 08

Simplification and Approximation – Competitive Examination Shortcut Techniques - Number Systems - Simple and Compound Interest-Progression

MODULE IV ANALYTICAL COMPETENCY 07

Blood Relations – Clocks and Calendars – Coding and Decoding – Analytical Reasoning(Linear Arrangement, Circular Arrangement, Cross Variable Relationship and Linear Relationship)– Directions .

L – 30; TOTAL HOURS – 30

REFERENCES:

1. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK
2. Swan, Michael (2005). Practical English Usage, Oxford University Press
3. Bhattacharya. Indrajit (2008). An Approach to Communication Skills, DhanpatRai& Co., (Pvt.) Ltd. New Delhi.
4. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
5. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017

6. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning , S. Chand Limited, 2010
7. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016
8. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
9. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019.

COURSE OUTCOMES:

CO1: Make effective business presentations

CO2: Speak English intelligibly, fluently and accurately in group discussions

CO3: To apply the various problem-solving techniques

CO4: Understand and solve aptitude problem

Board of Studies (BoS) :
13thBoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1										H					
CO2									M	H					
CO3					L	L									
CO4		M		L											
CO5															

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Statement: This course ensures capacity building and skills development requisite for implementing global partnership.

SEMESTER IV

CSD 2201	**COMPUTER COMMUNICATION AND NETWORKS**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the fundamental elements of network communications.

COB2: To study the functionalities of physical layer and data link layer.

COB3: To describe the operations performed in the network layer.

COB4: To introduce the responsibilities of the transport layers.

COB5: To explore the different protocols of application layer.

MODULE I NETWORKING FUNDAMENTALS 9

Introduction – Data Communication – Networks – Internet – Protocols and Standards - Network Models – Layered tasks – Layers in OSI Model – TCP/IP Protocol Suite – Addressing.

MODULE II PHYSICAL LAYER AND DATA LINK LAYER 9

Physical Layer - Digital Transmission – Analog Transmission – Bandwidth Utilization – Multiplexing and Spreading – Switching - Transmission Media – Data Link Layer – Error Detection and Correction – Data Link Control- Multiple Access – Wired LANs – Wireless LANs – Virtual Circuit Networks.

MODULE III NETWORK LAYER 9

Network Layer - Logical Addressing – Internet Protocol – Address Mapping – Error Reporting – Multicasting – Delivery – Forwarding – Routing – Shortest path routing – Link state routing – Hierarchical routing – Multicast and Broadcast routing.

MODULE IV TRANSPORT LAYER 9

Transport Layer – Process to Process Delivery – Client/Server Paradigm – Multiplexing and Demultiplexing – UDP – TCP – Flow Control – Error Control – Congestion Control – SCTP - Congestion Control and Quality of Service – Techniques to improve QoS – Integrated Services – Differentiated Services – QoS in Switched Networks.

MODULE V APPLICATION LAYER 9

Application Layer – Name Space – Domain Name Space – DNS in Internet – Resolution – DNS Messages - Remote Logging – E-Mail – SMTP – POP – IMAP - File Transfer – WWW – Web Documents - HTTP – Network Management

System - Simple Network Management Protocol – Multimedia – Digitizing Audio and Video – Streaming stored Audio and Video – RTCP – Voice Over IP.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Gerry Howser, Computer Networks and the Internet: A Hands-On Approach, Springer, ISBN-13: 9783030344955, 2019.
2. A. Tanenbaum and D. Wetherall, Computer Networks, 5th edition, Pearson, ISBN-13: 9780132126953, 2013.

REFERENCES:

1. Behrouz Forouzan, Data Communications and Networking, McGraw Hill Higher Education, ISBN-13: 9780072967753, 2013.
2. Peterson and Davie, "Computer Networks: A Systems Approach", 5th edition, ISBN: 9780123850591, 2012.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Analyze the important elements present in the computer network and communications.

CO2: Illustrate the working of physical and data link layer of computer networks.

CO3: Implement the various functionalities of the network layer and understand its importance.

CO4: Interpret the basics of transport layer protocols and review their advantages and disadvantages

CO5: Identify and illustrate the various application layer methods and assess their significance**.**

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1	H	H	H	M	M			L	H		H	L	H	H
CO2	H	L	M	L	L			L	M	M	H	L	H	L
CO3	H	M	H	M	M			L	H		M	L	H	H
CO4	H	H	H	L	L			L	H	M	H	L	H	L
CO5	M	M	M	L	L			L	M	H	H	L	H	L

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement : The comprehensive understanding of analysis, design and implementation of secure and efficient networks aids in effective communication that leads to construction of resilient infrastructure and sustainable industrialization.

CSD 2202	ANALYSIS OF ALGORITHMS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the asymptotic performance of algorithms.

COB2:To acquire knowledge onprinciples of algorithm design.

COB3:To become familiar with divide and conquer techniques.

COB4: To study the different algorithmic design strategies.

COB5:To explore the significance of NP- completeness.

MODULE I INTRODUCTION 9

Algorithm - Fundamentals of Algorithmic Problem Solving – Important Problem Types - Fundamental Data Structures – Analysis Framework – Asymptotic Notations and Basic Efficiency Classes – Mathematical Analysis of Recursive and Non-Recursive Algorithms - Empirical Analysis of Algorithm-Algorithm Visualization.

MODULE II BRUTE FORCE 9

Selection Sort and Bubble Sort – Sequential Search and Brute Force String matching – Closest pair and Convex Hull Problems by Brute Force – Exhaustive Search – Depth First Search and Breadth First Search – Insertion Sort – Topological Sorting – Algorithms for Generating Combinatorial Objects – Decrease by a Constant Factor Algorithms – Variable Size Decrease Algorithms.

MODULE III DIVIDE AND CONQUER 9

Merge Sort – Quick Sort - Binary Tree Traversals and Related Properties – Multiplication of Large Integers and Strassen's Matrix Multiplication – The Closest Pair and Convex Hull Problems by Divide and Conquer – Presorting – Gaussian Elimination – Balanced Search Trees – Heaps and Heap Sort – Horner's Rule and Binary Exponentiation – Problem Reduction.

MODULE IV DYNAMIC PROGRAMMING AND COMPUTATIONAL COMPLEXITY 9

Sorting by Counting – Input Enhancement in String Matching – Hashing – B-Trees – Knapsack Problems and Memory Functions – Optimal Binary Search Trees – Warshall's and Floyd's Algorithm.

MODULE V NP-COMPLETE AND NP-HARD PROBLEM 9

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes – Decision Trees – PNP and NP Complete Problems – Challenges of

Numerical Algorithms – Backtracking – Branch and Bound – Approximation Algorithms for NP Hard Problems – Algorithms for Solving Non Linear Equations - External-Memory Algorithms -Parallel Algorithms.

L –45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. AnanyLevitin,"Introduction to the Design and Analysis of Algorithm",Pearson Education Limited,ThirdEdition,ISBN-10 : 9332585482, ISBN-13 : 978-9332585485, 2017.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Third edition, Prentice Hall of India Private Limited, ISBN: 9780262533058, 0262533057, 2009.

REFERENCES:

1. Rajesh K.Shukla,"Analysis and Design of Algorithms",Wiley India Private Limited,ISBN : 978–81-265-5477-5,ISBN:978-81-265-8214-3, 2015.
2. Tim Roughgarden "Algorithm Illuminated: The Basic: 1 (Algorithms illuminated)",SoundlikeyourselfPublishing,LLC;Illustrate,ISBN-10:0999282905, ISBN -13 978-0999282908, 2017.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Analyze best case, average case and worst-case running times of algorithms using asymptotic analysis.

CO2: Apply design principles and concepts to algorithm design.

CO3: Implement algorithms using the divide and conquer.

CO4: Design new data structures by augmenting existing data structures and design algorithms that employ data structures.

CO5: Justify the appropriate algorithmic technique for solving real world problems.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO 5	PO 6	P O7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	H	H	M	M	L			L	L	-	L	L	H	M
CO2	M	H	M	M	L			L	L	-	L	L	H	M
CO3	M	H	M	L	L			L	L	-	L	L	H	M
CO4	M	H	H	L	L			L	L	M	L	L	H	L
CO5	M	H	H	H	L			L	L	M	M	L	H	M

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement:
By learning “Analysis of Algorithm”, students can apply algorithms in order to take actions in complex decision-making environment, which in turn leads to sustainable economic growth and enormous employment opportunities.

CSD 2203	COMPUTER ARCHITECTURE AND MICROPROCESSOR	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To study the basics of organizational and architectural issues of a digital computer.

COB2: To learn an in-depth understanding of the operation of Central processing unit and Instruction level Parallelism.

COB3: To provide the essentials of the processors and Develop assembly level programs using 8085.

COB4: To give fundamental architecture of 16 bit and 32 bit microprocessor.

COB5: To impart the knowledge about Control unit and the ideas about parallel organization.

MODULE I BASIC STRUCTURE OF COMPUTERS 09

Basics – Computer evolution and performance – Computer functions and interconnections – Computer Arithmetic - The Arithmetic and Logic Unit - Integer Representation - Integer Arithmetic - Floating-Point Representation - Floating-Point Arithmetic.

MODULE II PROCESSOR STRUCTURE AND FUNCTION 09

Processor Structure and Function - Processor Organization - Register Organization - Instruction Cycle - Instruction Pipelining - The x86 Processor Family -Basic Concepts – Microinstruction Sequencing -Microinstruction Execution.

MODULE III MEMORY AND I/O 09

Cache Memory - Computer Memory System Overview - Cache Memory Principles - Elements of Cache Design - Internal Memory - External Memory - Input/Output - External Devices - I/O Modules - Programmed I/O - Interrupt-Driven I/O - Direct Memory Access.

MODULE IV BASICS OF MICROPROCESSOR 09

Introduction to Microprocessors - Microprocessor systems with bus organization - Microprocessor architecture and operation, 8085 Microprocessor and its operation - 8085 instruction cycle - machine cycle - T states - Addressing modes in 8085.

MODULE V 8086 SYSTEM BUS STRUCTURE 09

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

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. William Stallings, "Computer Organization and Architecture - Designing for Performance", 10th edition, Pearson Education, ISBN-13: 978013410613, 2015.
2. Ramesh Goankar, “Microprocessor architecture, programming and applications with 8085”, 6th edition, Penram International Publishing, ISBN: 978-8187972884, 2016.

REFERENCES:

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", 5th edition, McGraw Hill, ISBN 13:9781259005275, 2002.
2. John Kennessy and David Patterson, “Computer Architecture”, 5th edition, ISBN: 9780123838728, 2011.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Apply the basic knowledge of digital concepts to the functional components of a Computer System

CO2: Recognize various processing units within the CPU of a Computer System

CO3: Interpret the functionality of the memory unit and its types of input/output processing

CO4: Develop assembly language programs suitable for real-time applications using microprocessors.

CO5: Demonstrate the system design and multiprogramming concepts of a microprocessor.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	L			L	M		L	M	H	M
CO2	H	M	M	L	M			L	M	L	L	M	H	M
CO3	H	H	M	L	L			L	M	L	L	M	H	M
CO24	H	H	H	M	M			L	H	L	L	M	H	H
CO5	H	M	L	L	L			L	M	L	L	M	H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 :Build resilient infrastructure, promote sustainable industrialization and foster innovation.

Statement : By learning computer architecture and microprocessor the students are able to design the architecture of a system refers to its structure in terms of separately specified components of that system and their interrelationships.

CSD 2204	OPERATING SYSTEMS	L	T	P	C
SDG: 9		3	0	2	4

COURSE OBJECTIVES:

COB1: To know the objectives, functions and architecture of operating systems.

COB2: To understand process management concepts.

COB3: To study the functions of process concurrency and synchronization.

COB4: To provide knowledge about how the memory management is done with the help of operating systems.

COB5: To learn different disk scheduling and file management techniques.

MODULE I **OVERVIEW OF OPERATING SYSTEMS** **9**

Operating Systems Objectives and Functions - Evolution of the Operating systems - Operating System Services – System Calls –Operating System Structures. Case Study - Windows Operating systems, Linux operating systems, Operating system for hand held devices.

MODULE II **PROCESS SCHEDULING** **9**

Process Life cycle - Process control - Threads - Multithreads - Scheduling criteria - Types of scheduling – non-pre-emptive and pre-emptive CPU scheduling algorithms.

MODULE III **PROCESS SYNCHRONISATION** **9**

Concurrent process - Principles of Concurrency – Inter Process Communication - The Critical-Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors. Deadlock - Deadlock Prevention, Avoidance, Detection and recovery.

MODULE IV **MEMORY MANAGEMENT** **9**

Introduction - Partitions - Paging - Segmentation - Segmentation and paging - Need for virtual memory management - Demand Paging - Page fault and page replacement policies.

MODULE V **DISK SCHEDULING AND FILE MANAGEMENT** **9**

I/O subsystems - Disk I/O - Disk Scheduling algorithms - File Management: Principles - File management Techniques - File directories - File System Architecture - File allocation.

L –45 ; P – 30; TOTAL HOURS –75

PRACTICALS

LIST OF EXPERIMENTS

1. Shell Programming and I/O System Calls
2. Implementation of Process Management
3. Implementation of Process Synchronization
4. Demonstrate the use of threads under LINUX platform using appropriate thread API
5. Write a program to Implement Producer Consumer Problem solution
6. Write a program to Implement Dining philosopher's problem solution
7. write a program to implement Processor Scheduling Algorithms:
   a) FCFS b) SJF
8. Write a program to simulate Bankers Algorithm for Dead Lock Avoidance.
9. Write a program to Implement Page replacement Algorithms:
   a) FIFO b) LRU
10. Write a program to implement disk scheduling algorithms:
    a) FCFS b) SCAN

L –45 ; P - 30:TOTAL HOURS –75

TEXT BOOKS AND REFERNCES:

1. Abraham SilberSchatz, Peter B Galvin, Greg Gagne, "Operating System Concepts", 9th edition, John Wiley & Sons Inc, ISBN:978-1-118- 06333-0, 2013.
2. Deitel H M, "Operating Systems", 3rd edition, Pearson education India, New Delhi, ISBN: 978-0-536-21215-3, 2007.
3. Dhamdhere D M, "Operating Systems", 1streprint, Tata McGraw Hill, New Delhi, ISBN 978–0–07–295769–3, 2006.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify the operating system services and examine the evolution of operating systems.

CO2: Compare the performance of various process scheduling algorithms.

CO3: Evaluate the implementation of processes and problems related to process synchronization and deadlocks.

CO4: Apply suitable page replacement algorithms and summarize memory management problems and segmentation.

CO5: Interpret the mechanisms adopted for disk scheduling algorithms

Board of Studies (BoS) :	**Academic Council:**
22nd BoS of CSE held on 17.08.2023	21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	L	L	-	-	-	L	-	-	-	L	H	H
CO2	H	H	M	L	-	-	-	L	-	L	-	L	H	H
CO3	H	H	M	M	L	-	-	L	-	L	-	L	H	L
CO4	H	H	M	M	-	-	-	L	-	-	-	L	H	M
CO5	H	M	L	L	-	-	-	L	-	L	-	L	H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement : This course describes the operating system abstractions, mechanisms, policies for resource scheduling and allocation and their implementations. By comparing the different operating system available, innovations in developing new operating systems as per the applications may be carried out.

CSD 2205	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamental concepts of Database Management Systems.

COB2: To learn about relational database design and SQL commands.

COB3: To explore the need for normalization in database systems.

COB4: To familiarize the basic concepts of query optimization, transaction management and concurrency control.

COB5: To study the database recovery and security mechanisms.

MODULE I INTRODUCTION TO DATABASE SYSTEMS 10

Introduction - Characteristics of Database approach – Roles of database users - Advantages of using DBMS approach - Database applications - Data models, schemas and instances –Components of DBMS - Database languages and interfaces - Database system environment - Classification of Database Management Systems - Entity Relationship Model - Basic ER Concepts - ER Diagram Symbols - Refining ER Design- ER to Relational Mapping.

MODULE II RELATIONAL ALGEBRA AND SQL 09

Relational Model: Relational Model Constraints and Relational Database Schemas –Relational Algebra - Unary Relational Operations: SELECT and PROJECT - Relational Algebra Operations from Set Theory - Binary Relational Operations: JOIN and DIVISION – Introduction to SQL - SQL Basic Queries- Intermediate SQL – Advanced SQL.

MODULE III FUNCTIONAL DEPENDENCIES AND NORMAL FORMS 08

Introduction to schema refinement-Need for Decomposition - Data Anomalies - Functional Dependency - Normalization -1 NF - 2 NF - 3 NF - Boyce-Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form - Join Dependencies and Fifth Normal Form - Domain Key Normal Form – Denormalization.

MODULE IV QUERY OPTIMIZATION AND TRANSACTION PROCESSING 09

Query Processing - Syntax Analyzer - Query Decomposition and Optimization - Cost Estimation in Query Optimization -Pipelining and Materialization - Structure of Query Evaluation Plans - Transaction Processing and Concurrency Control -

Transaction Concepts - Concurrency Control - Locking Methods for Concurrency Control.

MODULE V RECOVERY AND SECURITY 09

Database Recovery Concepts – Types of Database Failures – Types of Database Recovery – Recovery Techniques – Buffer Management – Database Security – Goals of Database Security – NoSQL Database – Applications.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw-Hill, ISBN 9780078022159, 7thEdition, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson, 7th edition,ISBN-13: 978-0-13-397077-7, 2016.

REFERENCES:

1. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Mc Graw Hill, 8th edition, ISBN-13: 978-0321197849, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd edition, McGraw-Hill,ISBN: 978-9339213114, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the fundamental concepts of Database Base Management Systems.

CO2: Design Entity Relationship model for the given application and write queries using SQL commands.

CO3: Choose the proper normalization technique and apply it in the database systems.

CO4: Apply the transaction management and concurrency control techniques in real time applications.

CO5: Identify the possible threats in database security and provide necessary recovery mechanisms.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	L	-	-	-	L		-	-	L	H	-L
CO2	H	M	H	M	L	-	-	-L	H	L	M	L	H	M
CO3	M	L	L	L	-	-	-	-L		-		L	H	L
CO4	M	L	L	L			-	-L	L	-		L	H	H
CO5	H	H	M	L	L		-	-L	H	L	-	L	H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient infrastructure, promote sustainable industrialization and foster innovation.

Statement : To comprehend and evaluate the role of database management systems, with an emphasis on how to organize, maintain and retrieve information from a DBMS efficiently, and effectively in information technology applications within organizations.

CSD 2206	**COMPUTER COMMUNICATION**	**L**	**T**	**P**	**C**
SDG: 9	**AND NETWORKS LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To expose networking concepts using simple programs.

COB2: To illustrate communication between two entities using various constructs.

COB3: To emulate client server architecture using different protocols.

COB4: To explore the error handling and correction mechanisms in networks.

COB5: To illustrate different routing protocols and algorithms for reliable data transfer.

PRACTICALS

List of Experiments:

1. Write a socket Program for Echo / Ping / Talk commands.
2. Create a socket (TCP) between two computers and enable file transfer between them.
3. Write a program to implement Remote Command Execution
4. Write a program to implement CRC and Hamming code for error handling.
5. Write a code simulating Sliding Window Protocols.
6. A Client Server application for chat.
7. Write a program for File Transfer in client-server architecture using following methods.
   a. USING RS232C b. TCP/IP
8. Perform implementation of routing algorithms to select the network path with its optimum and economical during data transfer.

a. Shortest path routing b. Flooding c. Link State d. Hierarchical

P – 30; TOTAL HOURS – 30

TEXT BOOKS:

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, ISBN:9780133594140,2017.
2. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols, and Architecture” 6thEdition, PHI, ISBN: 9780136085300, 2014.
3. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 5thEdition, illustrated, ISBN: 9780073376226, 2012.

REFERENCES:

1. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” Elsevier, 5th Edition, ISBN: 978-0123850591, 2012.
2. Andrew S. Tanenbaum, "Computer Networks", Prentice-Hall of India, 4th Edition, ISBN: 9780130661029, 2003.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Apply basic concept of TCP/IP protocol and implement it.

CO2: Simulate network protocols to check the functionality of different routing algorithms for efficient data transfer without data loss.

CO3: Implement error check and control mechanisms in communication.

CO4: Develop simple security mechanisms in the networking applications.

CO5: Implement real time application using client server architecture.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	M	L			L	H		M	L	H	M
CO2	H	M	M	M	M			L	H		M	L	H	H
CO3	H	M	H	M				L	H	M	M	L	H	M
CO4	H	M	H	M				L	H	M	H	L	H	M
CO5	H	M	H	H	H			L	H		H	L	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement : Exposing to Networking concepts provides security solutions for industrial applications within the networking environment.

CSD 2207 **L T P C**

SDG: 4 **DATABASE MANAGEMENT SYSTEMS LABORATORY** **0 0 2 1**

COURSE OBJECTIVES:

COB1: To understand the basics of SQL.

COB2: To learn queries using SQL in database creation and interaction.

COB3: To familiarize SQL commands for data handling and manipulation.

COB4: To explore NOSQL commands for database application. .

COB5: To learn JDBC/ODBC connectivity.

PRACTICALS

List of Experiments:

1. Creating, altering and dropping tables with integrity constraints using DDL commands.
2. Retrieving and modifying data from a database using DML Statements.
3. Retrieving data from database using IN, BETWEEN, LIKE, ORDER BY,GROUP BY and HAVING clause.
4. Use of scalar and aggregate functions.
5. Retrieving data from a database using Join operations(Inner and Outer Joins).
6. Using sub queries or complex queries for retrieving data.
7. Simple PL/SQL Programs.
8. Use of implicit & explicit cursors in data handling.
9. Use of stored procedures & functions in data manipulation.
10. Use of trigger in data manipulation.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application using NOSQL.
13. Applications development not limited to
    a. Web portal development with a dynamic content management
    b. Document repository management
    c. Music recommendation system
    d. Student management system
    e. Stock exchange management system
    f. Project management panel

P – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Jan L. Harrington, “Relational Database Design and Implementation”, Morgan Kaufmann publisher, 4th Edition, ISBN: 978-012 8043998, 2016.

REFERENCES:

1. Meg Bernal, Tammie Dang, Acacio Ricardo Gomes Pessoa," IBM DB2 12 for Z/OS Technical Overview", IBM Redbooks Publication, ISBN: 9780738442303, 2019.
2. Yan Li, "Handbook of Research on Innovative Database Query Processing Techniques", Idea Group, 1stEdition, ISBN: 9781466687677, 2015.
3. ShashankTiwari, "Professional NoSQL", O'Reilly Media, 1stEdition, ISBN-13 : 978-0470942246, 2011.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Write queries using SQL in database creation and interaction.

CO2: Cosnstruct queries to solve join operations in database applications.

CO3: Write SQL commands for data handling and manipulations.

CO4: Implement NOSQL commands for database applications.

CO5: Apply JDBC/ODBC connectivity in real time application projects.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2
CO1	M	L	L	L	-	-	-	L	M	L	L	1	H	M
CO2	H	M	M	M	-	-	-	L	H	L	M	M	H	M
CO3	H	M	H	H	M	-	-	L	H-	L	-H	1	H	H
CO4	H	L	H	M	-	-	-	L	H	L	M	L	H	L
CO5	H	M	M	M	M		-	L	H	L	L	L	M	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Quality Education

Statement : The students will play a key role in driving technological and societal progress through research, discovery, knowledge creation and dissemination. They educate and equip young people with the knowledge, acquired by building various models.

GED 2202	INDIAN CONSTITUTION AND HUMAN RIGHTS	L	T	P	C
SDG: 16		2	0	0	0

COURSE OBJECTIVES:

COB1: To explicate the emergence and evolution of Indian Constitution.

COB2: To have an insight into the philosophy of fundamental rights and duties, and Directive Principles.

COB3: To differentiate the structure of executive, legislature and judiciary.

COB4: To understand human rights and its implication - local and international and redressal mechanism.

MODULE I INTRODUCTION AND BASIC INFORMATION ABOUT INDIAN CONSTITUTION **8**

Meaning of the constitution law and constitutionalism - Historical Background of the Constituent Assembly - Government of India Act of 1935 and Indian Independence Act of 1947 - The Constituent Assembly of India - Enforcement of the Constitution - Indian Constitution and its Salient Features - The Preamble of the Constitution. Citizenship.

MODULE II FUNDAMENTAL RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES **7**

Fundamental Rights and its Restriction and limitations in different complex situations - Directive Principles of State Policy (DPSP) & its present relevance in our society with examples- Fundamental Duties and its Scope and significance in nation building - Right to Information Act 2005.

MODULE III GOVERNANCE IN INDIA **8**

The Union Executive – the President and the Vice-President – The Council of Ministers and the Prime Minister – Powers and functions. The Union legislature – The Parliament – The Lok Sabha and the Rajya Sabha, Composition, powers and functions – Government of the State - The Governor – the Council of Ministers and the Chief Minister – Powers and Functions-Elections-Electoral Process and Election Commission of India - Indian judicial system.

MODULE IV HUMAN RIGHTS AND INDIAN CONSTITUTION **7**

Human rights – meaning and significance - Covenant on civil and political rights - Covenant on Economic, Social and Cultural rights - UN mechanism and agencies - The Protection of Human Rights Act, 1993 – watch on

human rights and enforcement - Roles of National Human Rights Commission of India - Special Constitutional Provisions for SC & ST, OBC - Special Provision for Women, Children & Backward Classes.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. B.K. Sharma, Introduction to the Constitution of India, 6th ed., PHI Learning Private Limited, New Delhi 2011
2. Durga Das Basu "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th / 20th Edn. 2008
3. M.P. Jain, Indian Constitutional Law, 7th ed., LexisNexis, Gurgaon. 2014.

REFERENCES:

1. Fadia B.L "Indian Government and Politics", Sahitya Bhavan Publications. 2010
2. Kashyap Subhash C "Our Constitution: An Introduction to India's Constitution and constitutional Law, NBT. 2017
3. M.V.Pylee "An Introduction to Constitution of India", Vikas Publishing. 2002
4. Sharma Brij Kishore "Introduction to the Indian Constitution", 8th Edition, PHI Learning Pvt. Ltd. 2015
5. Latest Publications of NHRC - Indian Institute of Human Rights, New Delhi.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: describe the emergence and evolution of Indian Constitution.

CO2: realize the status and importance of fundamental rights, fundamental duties and directive principles of state policy and relation among them by understanding the articulation of its basic values under the Constitution of India.

CO3: compare the various structure of Indian government.

CO4: recognize the human rights, cultural, social and political rights and its relationship with Indian constitution. .

Board of Studies (BoS) :
4thBoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			M			H	M	L	M		M	
CO2			H			M	H	M			H	
CO3			M			H	M	L			L	
CO4			H			H	H	M	M			H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Application of human, legal and political rights leading to empowerment in real-life situations for protection of fundamental freedoms and freedom from violence, abuse, trafficking and exploitation are at the core of human rights.

GED 2201	WORKPLACE SKILLS AND APTITUDE FOR ENGINEERS	L	T	P	C
SDG: 8		0	0	2	1

COURSE OBJECTIVES:

COB1: To expose them to reading for specific purposes, especially in professional contexts

COB2: To expose them to the process of different kinds of formal Writing

COB3: To prepare the students to be successful in their career

COB4: To familiarize various problem-solving techniques in aptitude and puzzles.

MODULE I EXTENSIVE READING & WRITING 07

Reading for comprehension - inferring and note-making – Process of writing-paragraph development - elements of business writing: Email, memos.

MODULE II INTENSIVE READING & WRITING 08

Intensive reading and reviewing - Interpretation of charts, graphs - Résumé - Letter of enquiry, thanksgiving letters.

MODULE III QUANTITATIVE APTITUDE 08

Percentage - Ratio and Proportion - Profit and Loss – Averages, Allegations and Mixtures.

MODULE IV LOGICAL COMPETENCY 07

Syllogism – Blood Relations- Number, Alpha and Alpha numeric series - Puzzles – Cubes and Dice - Odd One Out-Coding and Decoding

L – 30; TOTAL HOURS - 30

REFERENCES:

1. Sharma, R.C. and Mohan, Krishna (2010). Business Correspondence and Report Writing. 4th edition. Tata McGraw Hill Education Private Limited, New Delhi
2. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK
3. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
4. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017
5. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning , S. Chand Limited, 2010

6. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016
7. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
8. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019.

COURSE OUTCOMES:

CO1: Demonstrate reading skills with reference to business related texts

CO2: Draft professional documents by using the three stages of writing

CO3: Apply various short cut techniques for solving complicated aptitude Problems

CO4: To understand various problems and patterns of different ways to solve it

Board of Studies (BoS) :
13thBoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L		H						H					
CO2			L							H					
CO3			L				M								
CO4		H		M											
CO5															

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8:Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement:Demonstrating, Drafting and applying various techniques for sustainable growth to employment.

SEMESTER V

CSD 3101	THEORY OF COMPUTATION	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the theoretical foundations of computer science from the perspective of formal languages

COB2: To study automata theory and the computation problems that can be solved using these abstract machines.

COB3: To gain knowledge on how a regular language is built from a base set of regular languages.

COB4: To provide knowledge on generating possible pattern of strings for a given language using context free grammar.

COB5: To learn push down automata and the features of a Turing machine.

MODULE I INTRODUCTION 9

Why study Automata Theory- Introduction to Formal Proof - Additional Forms of Proof Inductive Proofs- The Central Concepts of Automata Theory.

MODULE II FINITE AUTOMATA 9

An Informal Picture of Finite Automata- Deterministic Finite Automata- Nondeterministic - Finite Automata- Finite Automata With Epsilon Transitions-Equivalence of Automata

MODULE III REGULAR EXPRESSIONS 9

Regular Expressions- Finite Automata and Regular Expressions-Pumping Lemma of regular languages- Properties of regular languages.

MODULE IV CONTEXT-FREE GRAMMARS AND LANGUAGES 9

Context-Free Grammars- Parse Trees- Ambiguity in Grammars and Languages- Normal - Forms of Context Free Grammars- Pumping Lemma of Context Free Languages.

MODULE V PUSH DOWN AUTOMATA 9

Definition of the Pushdown Automaton - The Languages of a PDA Equivalence of PDA's and CFG's- Deterministic Pushdown Automata - The Turing Machine- Programming Techniques for Turing Machines

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. John Hopcroft, Rajeev Motwani& Jeffry Ullman "Introduction to Automata Theory, Languages & Computation", 3rd Edition, Pearson Education, 2012, ISBN : 978-0201029888.

REFERENCES:

1.John C Martin, "Introduction to Languages and Automata Theory", 3rd Reprint Edition, Tata McGraw-Hill, 2008. ISBN: 978-1118014783.

2.Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, PWS Publishing Company, 2013. ISBN: 978-1133187790.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Apply mathematical proofs of induction to computation problem.

CO2: Solve simple problems in RE, DFA's, NFA's, Turing machines, and Grammars.

CO3: Design Finite Automata's for Regular Expressions and Languages.

CO4: Derive context free grammar for various languages and apply normal form techniques for ambiguity.

CO5: Solve various problems using push down automata and Turing Machines.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H	L		L		L						H	
CO2	L	H	L	L									H	
CO3		M	H	L	L								L	
CO4	L	L	M	M									M	
CO5	L	L	H	H	M								H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The learner is able to use all opportunities for their own education throughout their life, and to apply the acquired knowledge in everyday situations to promote sustainable development.

CSD 3102	ARTIFICIAL INTELLIGENCE TECHNIQUES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To give appropriate Artificial Intelligence methods to solve a given problem.

COB2: To learn the different search strategies in AI.

COB3: To explore the facts and concepts of computational model and their applications.

COB4: To gain knowledge on planning strategy for real time problems.

COB5: To introduce the concepts of Expert Systems.

MODULE I INTRODUCTION 9

Introduction to Artificial Intelligence(AI) - History of AI- AI Techniques - Problem Solving with AI - AI models - Data Acquisition and Learning Aspects in AI - Problem-Solving Process - Formulating Problems - Problem Types and Characteristics - Problem Analysis and Representation - Performance Measuring - Problem Space and Search - Toy Problems - Real-world problems - Problem Reduction Methods.

MODULE II HEURISTIC SEARCH TECHNIQUES 9

General Search algorithm – Uniformed Search Methods – BFS, Uniform Cost Search - Depth First search , Depth Limited search (DLS), Iterative Deepening - Informed Search-Introduction- Generate and Test, BFS, A* Search, Memory Bounded Heuristic Search - Local Search Algorithms and Optimization Problems – Hill climbing and Simulated Annealing.

MODULE III KNOWLEDGE AND REASONING 9

Knowledge Representation-Knowledge based Agents-The Wumpus World - Logic-Propositional Logic-Predicate Logic-Unification and Lifting - Representing Knowledge using Rules-Semantic Networks Frame Systems - Inference – Types of Reasoning.

MODULE IV PLANNING 9

Planning Problem – Simple Planning agent –Blocks world - Goal Stack Planning-Means Ends Analysis- Planning as a Statespace Search - Partial Order Planning-Planning Graphs-Hierarchical Planning - Non- linear Planning -Conditional Planning-Reactive Planning - Knowledge based

Planning-Using Temporal Logic – Execution Monitoring and Re-planning-Continuous Planning-Multi-agent Planning-Job shop Scheduling Problem.

MODULE V GAME PLAYING 9

Introduction-Important Concepts of Game Theory - Game Playing and Knowledge Structure-Game as a Search Problem -Alpha-beta Pruning-Game Theory Problems Game Theory - Expert System-Architecture-Knowledge acquisition-Rule based Expert System-Frame based and Fuzzy based expert system- Case study in AI Applications.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig., "Artificial Intelligence - A Modern Approach", Prentice Hall Publishers, 4th edition, ISBN-13 : 978-1292401133, 2021.

REFERENCES:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence", Mc Graw Hill Education, 3rd edition, ISBN-13 : 978-0070087705, 2017.
2. Parag Kulkarni, Prachi Joshi, "Artificial Intelligence –Building Intelligent Systems", PHI learning private Ltd, 1st edition, ISBN-13 : 978-8120350465, 2015.
3. Deepak Khemani "Artificial Intelligence", Mc Graw Hill Education, ISBN-13 : 978-1259029981, 2017.

COURSE OUTCOMES:

CO1:Solve basic AI based problems.

CO2:Apply AI techniques to real-world problems and develop intelligent systems.

CO3:Implement basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO4:Design and implement AI planning systems.

CO5:Develop good evaluation functions and strategies for game playing and expert systems using fuzzy logic.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2
CO1	H	M	H	H	M	-	-	L	M	H	H	L	H	L
CO2	M	M	L	L	L	-	-	L	M	M	H	L	H	M
CO3	M	L	M	L	L	-	-	L	M	L	L	H	H	L
CO4	M	L	M	M	H	-	-	L	M	L	M	M	H	H
CO5	M	M	M	L	L	-	-	L	H	M	L	M	H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement :

The holistic understanding of AI techniques and the methods of solving problems using AI concepts in Game Playing, Natural Language Processing, Expert Systems and Machine Learning which enable the analysis of large and complex datasets for better products, more efficient software and optimized production.

CSD 3103	NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
SDG: 9		3	0	2	4

COURSE OBJECTIVES:

COB1: To provide an insight of the principles and practice of cryptography and network security.

COB2: To know the methods of conventional encryption, concepts of public key encryption and number theory.

COB3: To familiarize the various applications of cryptography and security issues.

COB4: To understand authentication and Hash functions

COB5: To get a wide knowledge on the different network security tools and applications.

MODULE I SECURITY CONCEPTS 9

The OSI Security Architecture – Security attacks – Security Services – Security Mechanisms – Classical Encryption Techniques – Substitution and Transposition Techniques -Basic concepts in Number Theory – Euclidean Algorithm – Modular Arithmetic Prime Numbers – Fermat's and Euler's Theorem – The Chinese Remainder Theorem

MODULE II SYMMETRIC CIPHERS 9

Block Ciphers and Data Encryption Standard – Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Strength of DES – Block Cipher Design Principles- Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Code book – Cipher BLOCKCHAINing Mode – Cipher Feedback Mode 0 Output Feedback Mode – Counter Mode

MODULE III PUBLIC KEY CRYPTOGRAPHY 9

Principles of Public key crypto Systems – RSA Algorithm - Diffie Hellman Key Exchange algorithm - Key Management - Elliptic Curve Arithmetic - Elliptic Curve Cryptography.

MODULE IV MESSAGE AUTHENTICATION AND HASH FUNCTIONS 9

Authentication Requirement – Function - Message Authentication Code -Hash Function - MD5 message digest algorithm - Secure hash algorithm (SHA) - Security of Hash Function and MAC.Digital Signature - Authentication Protocol - Digital Signature Standard.

MODULE V AUTHENTICATION APPLICATION 9

Kerberos - X.509 Authentication Service – Key Management and distribution – Symmetric Key Distribution using Symmetric Distribution – Public Key infrastructure - Email Security - Pretty Good Privacy and S/MIME. IP Security - Overview - IP Security Architecture - Authentication Header - Encapsulating Security Payload – Transport layer Security- Secure Socket Layer.

PRACTICALS

List of Experiments

1. Implement the Substitution and Transposition Techniques
2. Implement Key generation and DES
3. Implement Euclidean Algorithm
4. Implement RSA Algorithm
5. Implement Key exchange using Diffie Hellman
6. Demonstrate secure data transmission and Digital Signatures.
7. Implement PGP.
8. Implement MD5/SHA.
9. Implement Transport Layer security.
10. Explore different network security tools and applications.

L – 45; P – 30; TOTAL HOURS –75

TEXT BOOKS:

1. Williams Stallings “Cryptography and Network Security: Principles and Practice”, Pearson Education, 7th Edition, ISBN: 10:1-292-15858-1, 2016.

REFERENCES:

1. Charles P. Pfleeger, “Security in Computing”, 4th Edition, Prentice-Hall International, 2006.
2 Christ of Paar, Jan Pelzl& Bart Preneel, “Understanding Cryptography: A Textbook for Students and Practitioners”, 1st Edition, Springer, 2010.
3. Bruce Schneider, “Applied Cryptography Protocols, Algorithms, and Source Code in C”, 2nd Edition, John Wiley & Sons, 2007.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify basic security attacks and services and apply number theory concepts.

CO2: Compare symmetric and asymmetric key algorithms for cryptography.

CO3: Apply methods for authentication and generate hash functions.

CO4: Demonstrate Digital signatures and secure data transmissions.

CO5: Simulate the different tools in the domain of cryptography and network security.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	L	M	L	-	-	M	L	L	L	M	H	L
CO2	H	L	M	M	L	-	-	L	L	L	M	L	M	M
CO3	M	M	L	M	L	-	-	M	M	M	M	L	H	H
CO4	M	M	M	M	L	-	-	L	M	L	L	L	H	L
CO5	M	M	L	L	L	-	-	M	1	M	L	L	H	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: This course provides a comprehensive knowledge about the different aspects of security and thereby promote secure data transmissions that is very essential in the current scenario. It aids to enhance the research and innovations in the field of security and authentication of applications.

CSD 3104	DATA MINING AND DATA WAREHOUSING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the basic concepts and techniques of Data Mining.

COB2: To learn different data mining algorithms for Association rule mining.

COB3: To gain knowledge on classification and prediction models.

COB4: To expose various cluster analysis techniques.

COB5: To explore the need for data mining and data warehouse in real time applications.

MODULE I INTRODUCTION 9

Introduction – Different Types of Data - Technologies Used - Issues in Data Mining – Applications – Data Objects and Attributes – Data Preprocessing – Data Warehouse – Basic Concepts – Data Cube – Schemas – OLAP and OLTP operations – Design and Implementation – Supervised and Unsupervised Learning.

MODULE II ASSOCIATION RULE MINING 9

Basic Concepts - Frequent Item set Mining – Apriori Algorithm - Generating Association Rules - Improving the Efficiency of Apriori - Associations and Correlations: and Methods- Pattern Evaluation Methods.

MODULE III CLASSIFICATION AND PREDICTION 9

Classification and Prediction: - Issues Regarding Classification and Prediction - Classification by Decision Tree Introduction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines - Associative Classification - Lazy Learners - Prediction - Model Evaluation and Selection Accuracy and Error Measures.

MODULE IV CLUSTER ANALYSIS 9

Cluster Analysis: - Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods - Hierarchical methods - Density-Based Methods - Grid-Based Methods - Outlier Analysis.

MODULE V MULTIDIMENSIONAL ANALYSIS AND MINING ENVIRONMENT 9

Mining Object - Spatial Data – Multimedia Data – Text Mining - Web Data - Mining Complex Data Types -Data Mining and Society - Data Mining Environment: Case studies in building business environment -- Data Mining Applications.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Mohammed J. Zaki, Wagner Meira, Jr "Data Mining and AnalysisFundamental Concepts and Algorithms"Cambridge University Press, Second Edition, ISBN 9781108473989, 2020.
2. Jiawei Han, MichelineKamber, Jian Pei , "Data Mining: Concepts and Techniques", Elsevier Science, Third Edition, ISBN: 9780123814807,2012.

REFERENCES:

1. ParteekBhatia , "Data Mining and Data Warehousing Principles and Practical Techniques" Cambridge University Press", ISBN 9781108727747, 2019.
2. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition, PHI, 2006.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Illustrate the issues and challenges in data cleaning and processing with simple examples

CO2: Perform basic data mining operations and apply standard data mining algorithms for association rule mining.

CO3: Accurately predict the target class of the data for different real world problems.

CO4: Identify the distribution of data and observe the characteristics of each cluster.

CO5: Show the impact of data mining and warehousing techniques in real time industries.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	H	L	L		L	-	L	-	M	H	L
CO2	H	H	M	M	L	M	L	L	-	L	-	H	H	L
CO3	H	H	H	M		M	L	L	-	L	-	H	H	L
CO4	H	M	L	M	L	L	M	L	-	L	-	L	H	M
CO5	H	M	H	H	L	L	M	L	M	L	H	H	H	M

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement : The learner knows the pitfalls of unsustainable industrialization and in contrast knows examples of resilient, inclusive, sustainable industrial development and the need for contingency planning.

CSD 3105	INTERNET AND WEB	L	T	P	C
SDG: 9	PROGRAMMING LABORATORY	0	0	2	1

COURSE OBJECTIVES:

COB1: To be familiar with web page design using HTML and style sheets.

COB2: To develop dynamic web pages using client side scripting.

COB3: To create web pages using server side scripting.

COB4: To convert the static web pages into dynamic web pages.

COB5: To enable a student to design web applications using Servlets.

PRACTICALS

List of Experiments:

1. Personal home page design using HTML
2. Cascading style sheets.
3. Validating Web Form Controls
4. Displays the current time in a page and updates it afterevery minute.
5. JavaScript - automatically changing pictures on a web page.
6. JavaScript - a web page for Online Testing (MQC).
7. Invoke servlets from HTML forms.
8. Servlets to track the session and a hit count.
9. Convert the static web pages into dynamic web pages.
10. JSP - validate the user name and password.
11. JSP - Three-tier applications to save student marks.
12. Print the Student's total mark and grades by getting Register Number.

P –30 ; TOTAL HOURS –30

TEXT BOOKS:

1. AlokRanjan, Abhilasha Sinha, RanjitBattwad, “Javascript For Modern Web Development: Building A Web Application Using Html, Css, And Javascript”, BPB Publications, India, 2020.(ISBN:978-9389328721).
2. William Crawford, Jason Hunter, “Java Servlet Programming: Help for Server Side Java Developers”, Second Edition, Shroff publishers, India, 2011.(ISBN:978-8173662850).
3. Joel Murach, “Murachs Java Servlets & JSP”, Third Edition, Mike Murach& Associates Inc, USA, 2014.(ISBN:978-1890774783).

REFERENCES:

1. Bert Bates, Kathy Sierra, Bryan Basham, “Head First Servlets & JSP”, Newnes, Second Edition, Shroff publishers, India, 2011.
2. Jeffrey C and Jackson, “Web Technologies A Computer Science Perspective”,Pearson Education, 2011.
3. https://www.w3schools.com/html/default.asp

COURSE OUTCOMES:

CO1: Construct Web pages using HTML and style sheets.

CO2: Build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

CO3: Develop dynamic web pages using server side scripting.

CO4: Use Servlets to develop web applications.

CO5: Convert the static web pages into dynamic web pages.

Board of Studies (BoS) : **Academic Council:**

22nd BoS of CSE held on 17.08.2023 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	H	H	H	L	L			M	H	M	M	L	H	H
CO2	H	M	L	L	L			L	H	L	H	L	H	M
CO3	H	M	L	L	L			L	H	L	M	L	H	L
CO4	M	L	M	L	L			L	M	M	L	L	L	H
CO5	M	H	L	L	L			L	H	L	M	L	H	H

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Construct effective infrastructures, encourage inclusive and sustainable industrialization and adopt to the innovations

Statement: Internet communication system is one of the important part virtual infrastructures. The efficiency of the digital communication systems could be improvised by the innovative programming techniques.

CSD3106	**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY**	**L**	**T**	**P**	**C**
SDG: 4		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To find appropriate idealizations for converting real world problems into AI search problems.

COB2: To determine the hypothesis that best fits the training examples using concept learning.

COB3: To develop the skills in applying appropriate supervised, semi-supervised or unsupervised learning algorithms for solving practical problems .

COB4: To improve the neural network accuracy of predictions using backpropagation algorithms.

COB5: To identify innovative research directions in Artificial Intelligence and Machine Learning.

PRACTICALS

List of Experiments:

1. Implement A Star (*) Search Algorithm.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program
6. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

7. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

P – 30 ; TOTAL HOURS –30

TEXT BOOKS:

1. Daugherty, Paul R., and H. James Wilson. Human+ machine: reimagining work in the age of AI. Harvard Business Press, 2018.

REFERENCES:

1. Yaser S. Abu-Mostafa, Malik Magdon-Ismail l, Hsuan-Tien Lin, “Learning From Data”, AMLBook, ISBN-13: 978-1600490064, 2012.
2. Andriy Burkov, “Machine Learning Engineering”, True Positive Inc, ISBN 978-1777005467, 2020.

COURSE OUTCOMES:

CO1: Apply the suitable search algorithms to solve real time problems.

CO2: Identify the consistent hypotheses or concepts that best fits the training data.

CO3: Deploy appropriate classification and clustering techniques.

CO4: Analyze the neural network training using backpropagation.

CO5: Implement novel AI and machine learning techniques based on emerging real-world requirements.

Board of Studies (BoS) :Academic Council:

19thBoS of CSE held on 28.12.202119th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	H	H	M	M		L	M	H	H	L	H	L
CO2	M	M	L	L	L				M	M	H	L	H	M
CO3	M	L	M	L	L	M			M	L	L	H	H	L
CO4	M	L	M	M	H				M	L	M	M	H	H
CO5	M	M	M	L	L	H		L	H	M	L	M	H	M

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Quality Education

The students will play a key role in driving technological and societal progress through research, discovery, knowledge creation and dissemination. They educate and equip young people with the knowledge, acquired by building various models.

CSD 3107	INTERNSHIP – I	L	T	P	C
SDG: 9		0	0	0	1

COURSE OBJECTIVES:

COB1: To explore business concepts and theories in real-world decision-making.

COB2: To expose business skills in communication, technology, quantitative reasoning, and teamwork.

COB3: To understand the proficiency in business disciplines.

COB4: To familiarize a network of professional relationships and contacts.

COB5: To appreciate ideas to improve work effectiveness and efficiency by analysing challenges and considering viable options;

GUIDELINES:

- The students shall undergo industry training in any industry relevantto the field study or internship at research organizations / eminent academic institutions for the minimum period of 15 days during the summer vacation of second year.
- In any case, the student shall obtain necessary approval from the Head of the Department / Dean of School and the training has to be taken up at a stretch.
- In the case of industry internship, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department.
- The student shall also submit an internship completion certificate issued by the industry / research / academic organization.
- The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.
- The credit will be awarded in the 5th Semester.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s;

CO2: Solve real life challenges in the workplace by analysing work environment and conditions, and selecting appropriate skill sets acquired from the course;

CO3: Communicate and collaborate effectively and appropriately with different professionals in the work environment through written and oral means;

CO4: Exhibit critical thinking and problem solving skills by analysing underlying issue/s to challenges;

CO5: Interact with industry and provide solutions using modern software tools.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L	L	L	M	L	L	H	H	M	M	M	H	H
CO2	H	H	M	H	M	M	M	H	H	M	M	M	H	H
CO3	H	L	L	L	M	L	L	H	H	M	M	M	H	H
CO4	H	L	L	L	M	L	L	H	H	M	M	M	H	H
CO5	H	H	L	L	M	L	L	H	H	M	M	M	H	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The student acquires industrial and business experience through internship and can promote new and innovative ideas in the work place after graduation. Also the course enables the students to become a successful entrepreneur in their field of study.

GED 3101	COMMUNICATION SKILLS FOR CAREER SUCCESS	L	T	P	C
		0	0	2	1

SDG: 4

COURSE OBJECTIVES:

COB1: To develop students' proficiency in English at CEFR B2 level (Business Vantage)
COB2: To develop students' receptive skills (Listening and Reading) in a wide range of situations
COB3: To develop students' productive skills (Speaking and Writing) in a wide range of situations
COB4: To expose students to the nuances of the English language, grammar and usage.

MODULE I BRIEF EXCHANGES OF COMMUNICATION 08

Listening to telephonic conversations - gap filling exercises- short conversations – Promoting a product-Reading short passages and answering matching tasks- Writing short notes and messages. - Framing questions

MODULE II WORKPLACE COMMUNICATION 07

Listening to monologues - gap filling exercises - Mini presentations- role play- Reading longer texts – gap filling- Writing memo , emails and Fax - Writing reports on conferences, seminars

MODULE III INTERPERSONAL COMMUNICATION 08

Listening to conversations – Collaborative discussion using prompts - Reading comprehension-multiple choice-texts - Writing enquiry letters & replies to customers

MODULE IV NEGOTIATING AND PERSUADING 07

Listening to interviews - Group Discussions - Multiple choice and gap filling- writing work reports- cause and effect - Complaint letter and sales letter

P – 30 ; TOTAL HOURS –30

REFERENCES:

1. Guy Brook-Hart, 'Business Benchmark-Upper Intermediate, 2nd edition, Cambridge University Press, Shree MaitreyPrintechPvt. Ltd, Noida, 2016.
2. Leo Jones, 'New International Business English' Students book. Cambridge University Press, Cambridge, 2003.

3. Simon Sweeney, 'Communicating in Business' Teacher's Book. Cambridge University Press, Cambridge, 2004.
4. Simon Sweeney, 'Communicating in Business' Student's Book. Cambridge University Press, Cambridge, 2003.
5. Bill Mascull. 'Business Vocabulary in Use'. Advanced. Cambridge University Press, Cambridge, 2004

COURSE OUTCOMES:

CO1: Use the LSRW skills effectively in business and general situations

CO2: Demonstrate receptive skills effectively in various formal and informal communication situations.

CO3: Demonstrate productive skills effectively in various formal and informal communication situations

CO4: Use appropriate grammar and vocabulary in any context.

Board of Studies (BoS) : 13thBoS of the Department of English held on 17.6.2021

Academic Council: 17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O 3	PS O 4	PSO 5
CO1									M	H							H
CO2									M	H							H
CO3									M	H							H
CO4										H							M

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

This course helps the students to enhance their communication skills, critical thinking, problem solving, conflict resolution, team building and public speaking. This course also helps them to achieve success in their professional and personal life.

SEMESTER VI

MSD 3281	**ENTREPRENEURSHIP**	**L**	**T**	**P**	**C**
SDG: All 1-17.		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the fit between individual and their entrepreneurial ambitions.

COB2: To identify the customers and find a problem worth solving.

COB3: To create a business model for solving the problems of customer, forming solution and present the Business Model Canvas

COB4: To develop a solution for customers' problem and analyze the problem solution fit & product market fit.

COB5: To build and demonstrate a Minimum Viable Product (MVP) for startup

MODULE I PROBLEM IDENTIFICATION AND OPPORTUNITY DISCOVERY **9**

Entrepreneurial Thinking, Business Opportunities, Problem Identification, Design Thinking, Potential solutions, Presentation of the problem- Case Study

MODULE II CUSTOMER , SOLUTION AND BUSINESS MODEL **10**

Customers and Markets, Identification of Customer Segment, Niche Segment, Customers Jobs, Pain and Gain, Early Adopters, Value Proposition Canvas-Case Study, Basics of Business Model-Lean Canvas-Case Study.

MODULE III VALIDATION AND FINANCIALS **10**

Blue Ocean Strategy, Solution Demo, Problem – Solution Fit, Minimum Viable Product- Product Market Fit, Prototype – Case Study. Cost, Revenues, Pricing, Profitability Checks, Bootstrapping, Initial Financing and Pitching.

MODULE IV GO TO MARKET **8**

Positioning and Branding, Golden Circle model: Sinek's theory value proposition, Branding Elements,Market Penetration Strategy, Collaboration Tools and Techniques, Channels – Case Study

MODULE V MANAGING GROWTH AND FUNDING **8**

Sales Planning,Customer Acquisition Strategy, Selling Skills, Identifying Funding Sources, Mapping Start-Up Cycle to Funding Options, Funding Plan, , Creating business valuation

TOTAL HOURS – 45

TEXT BOOKS:

1. Entrepreneurship Rajeev Roy oxford, 2012.
2. https://web.nen.wfglobal.org/en/home - Wadhwani Foundation
3. W. Chan Kim , Renée A. Mauborgne**,** "Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant", Harvard Business Press, 2015.

REFERENCES:

1. Anil Lamba ,"Romancing the Balance Sheet: For Anyone Who Owns, Runs Or Manages a Business",HarperCollins Publishers India, 2016.
2. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.
3. "Anatomy of Business Plan" – Linda Pinson, OMIM publication , Seventh Edition, 2008.
4. Running Lean: Iterate From Plan A To a Plan That Works, Ash Maurya, "O'Reilly Media, Inc.", 28-Feb-2012.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Build an entrepreneurial mindset and reach out the customer to identify the problem using design thinking process

CO2: Craft solution to the problem through value proposition canvas and develop a business model using lean canvas

CO3: Provide product solution demo and deliver a minimum viable product

CO4: Work as a team and create brand strategy marketing for product/service

CO5: Prepare, make an outstanding sale pitch for startup

CSD 3201	BIG DATA AND CLOUD COMPUTING	L	T	P	C
SDG: 9		3	0	2	4

COURSE OBJECTIVES:

COB1: To explore the fundamental concepts of big data analytics

COB2: To learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop.

COB3: To understand the foundation on various types of cloud services, technologies and service providers.

COB4: To comprehend the technical capabilities and business benefits of virtualization and cloud computing.

COB5: To study the design challenges of Big Data and cloud.

MODULE I INTRODUCTION TO BIG DATA 9

Introduction - Big Data Analytics - Characteristics of Big Data - Big Data Architecture – Big Data Workflow - Applications.

MODULE II HADOOP ARCHITECTURE AND ECOSYSTEM 9

Hadoop Eco system –– Hadoop architecture – Hadoop cluster – HDFS – Working with distributed file System – MapReduce –- Spark – RDD – Storing and Querying Data.

MODULE III CLOUD FUNDAMENTALS 9

Technologies for Network based Computing - System Models for Distributed and Cloud Computing - Introduction to Cloud Computing – Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models - Cloud Computing Vendors.

MODULE IV CLOUD INFRASTRUCTURE 9

Hardware and Infrastructure – Thick and thin clients - Architectural Design – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Virtualization – Vmware.

MODULE V BIG DATA IN CLOUD 9

Challenges with Big Data – Big Data in Cloud – Big Data and Cloud in Real World – Case Study.

PRACTICALS

1. Hadoop Installation.
2. Simple program execution on Hadoop.
3. Python basic programming.
4. MapReduce problem using Python.
5. Database connectivity and query evaluation using HBase and Hive.
6. An application development on data analytics using real world Data.

L – 45 ; P-30 TOTAL HOURS - 75

TEXT BOOKS:

1. Benjamin Bengfort, Jenny Kim, “Data Analytics with Hadoop”, O'Reilly Media, Inc., First edition, ISBN : 1491913703, 2019.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, — “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, ISBN : 9780123858801, 2012.

REFERENCES:

1. Soraya Sedkaoui, “Data Analytics and Big Data”, First Edition, Wiley Publications, 2018. ISBN : 978-1-78630-326-4, 2018.
2. Sridhar Alla “Big data analytics with hadoop3:” Packt Publishing, ISBN:1788624955, 2019.
3. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd., ISBN : 9781259029950, 2013.
4. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, ISBN-13: 9780133387520, 2013.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Analyze the Hadoop and Map Reduce technologies associated with big data analytics.

CO2: Relate to data science and state the working of Hadoop architecture.

CO3: Identify the various cloud services and deployment models for specific application.

CO4: Articulate the main concepts, key technologies, strengths and limitations of Virtualization and Cloud computing.

CO5: Develop real time applications in cloud environment using Big Data concepts.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	H	M	H	L			L	M	H	H
CO2	M	M	H	H	H	M		L				H	M	M
CO3	M	L	H	L	H	L	L					M	H	L
CO4	H	H	H	M	H	H				M		H	H	H
CO5	H	H	H	H	H	H	L	M	L	M	H	H	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Big data and Cloud computing can provide critical aid to the existing response techniques and changes in the decision-making process enabling industrial processes and manufacturing to utilize enhanced technological advancements in sustainable industrialization.

CSD 3202	COMPILER DESIGN	L	T	P	C
SDG: 09		3	0	0	3

COURSE OBJECTIVES:

COB1: To outline the structure and Lexical analysis of a Compiler.

COB2: To learn the various parsing techniques of a Compiler.

COB3: To understand the intermediate code generation techniques for different constructs and expressions.

COB4: To gain an in-depth knowledge on basic blocks and flow graphs.

COB5: To explore the code optimization methods in compiler construction.

MODULE I LEXICAL ANALYSIS 08

The Structure of a Compiler - The Evolution of Programming Languages - The Science of Building a Compiler - Applications of Compiler Technology - Programming Language Basics – Lexical Analysis - The Role of the Lexical Analyzer – Symbol table - Input Buffering - Specification and Recognition of Tokens - The Lexical-Analyzer Generator Lex - Finite Automata.

MODULE II SYNTAX ANALYSIS 10

Context-Free Grammars - Writing a Grammar - Top-Down Parsing - Bottom-Up Parsing - Introduction to LR Parsing: Simple LR - More Powerful LR Parsers - Using Ambiguous Grammars - Parser Generators

MODULE III INTERMEDIATE CODE GENERATION 10

Syntax-Directed Definitions - Evaluation Orders for SDD's - Applications of Syntax-Directed Translation - Syntax-Directed Translation Schemes - Variants of Syntax Trees - Three-Address Code - Types and Declarations - Translation of Expressions - Type Checking - Control Flow – Back patching - Switch-Statements - Intermediate Code for Procedures.

MODULE IV RUN-TIME ENVIRONMENT AND CODE GENERATION 09

Storage Organization - Stack Allocation of Space - Access to Nonlocal Data on the Stack - Heap Management - Introduction to Garbage Collection - Issues in the Design of a Code Generator - The Target

Language - Addresses in the Target Code - Basic Blocks and Flow Graphs - Optimization of Basic Blocks - A Simple Code Generator - Register Allocation and Assignment .

MODULE V CODE OPTIMIZATION 08

The Principal Sources of Optimization - Peephole Optimization - Introduction to Data-Flow Analysis - Foundations of Data-Flow Analysis - Constant Propagation - Partial-Redundancy Elimination - Loops in Flow Graphs - Region-Based Analysis - Symbolic Analysis.

L – 45;TOTAL HOURS-45

TEXT BOOKS AND REFERENCES:

1. Des Watson, “A Practical Approach to Compiler Construction”, Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Interpret the sequential phases of a compiler.

CO2: Identify the tokens and parse the given input source code.

CO3: Construct intermediate code for programming constructs and expressions.

CO4: Analyze the different storage management and code generation techniques.

CO5: Optimize the target code by using relevant optimization techniques.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	M	-	-	-	L	-	L	M	H	H	M
CO2	M	H	L	H	L	-	-	L	L	L	-	M	M	M
CO3	H	M	L	M	L	-	-	L	-	-	-	H	H	H
CO4	H	H	M	L	M	-	-	L	-	-	M	H	H	H
CO5	H	H	H	H	M	-	-	L	-	L	M	H	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The design of lexical analyzers and developing code to implement mathematical operations and parsers promotes innovation. It provides an opportunity to innovation of new compilers.

CSD 3203	COMPILER LABORATORY	L	T	P	C
SDG: 9		0	0	2	1

COURSE OBJECTIVES:

COB1: To expose the working of various phases of compiler.

COB2: To introduce various compiler construction tools.

COB3: To explore tools to design lexical analyzer and produce a parser for a given grammar.

COB4: To understand various methods for converting three address code to assembly level program.

COB5: To introduce concept of code optimization of three address code for different programming statements.

PRACTICALS

List of Experiments:

1. Design a lexical analyzer for a given High Level Language. Ignore redundant space, tabs and new lines.
2. Study of compiler construction tools.
3. Implement a lexical analyzer using LEX tool.
4. Design and implement Top-Down parsing techniques and bottom-up parsing techniques using YAAC and LEX.
5. Implement a recursive descent parser for an expression grammar that generates arithmetic expressions with digits, + and *.
6. Implement a scientific calculator.
7. Generate abstract syntax tree and intermediate code for the given language.
8. Implement the front end of a compiler that generates the three-address code for a simple language.
9. Implement the back end of a compiler that generates the three-address code for a simple language.
10. Implement code optimization phase of the compiler.

P – 30; TOTAL HOURS –30

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Design a lexical analyzer to generates tokens for a programming syntax and display the symbol table.

CO2: Implement a Parser to parse a string to check if it belongs to a grammar.

CO3: Analyze the mathematical techniques to develop lexical and syntax analyzers.

CO4: Construct intermediate code for a programming construct.
CO5: Formulate an understanding of the various phases of compiler through Compiler construction tools.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1
CO1	H	H	H	M	L	-	-	L	H	L	-	L	H
CO2	H	H	M	M	L	-	-	L	H	L	-	L	H
CO3	H	H	M	H	L	-	-	L	H	L	-	M	M
CO4	H	H	H	M	L	-	-	L	H	L	-	L	M
CO5	H	M	H	M	M	-	-	L	H	L	H	M	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The design of lexical analyzers and developing code to implement mathematical operations and parsers promotes innovation. It provides an opportunity to innovation of new compilers.

CSD 3204	**MOBILE APPLICATION**	**L**	**T**	**P**	**C**
SDG: 9	**DEVELOPMENT LABORATORY**	**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To explore the various mobile development environments.

COB2: To study the user interface design and graphical design in mobile applications.

COB3: To learn the concept of multithreading in mobile environment.

COB4: To provide insight about Client-Server communication in mobile environment.

COB5: To expose the database connectivity for mobile application implementation.

PRACTICALS

List of Experiments:

1. To implement User Interface features.
2. To develop Layout designs in mobile devices.
3. To develop Action Listeners in mobile devices.
4. To create a simple calculator application.
5. To implement graphical design in mobile applications.
6. To connect applications to databases in the device.
7. To access RSS Feeds from web.
8. To develop mobile application that implements Multithreading.
9. To establish Client-Server communication.
10. An application development-Mini Project.

P – 30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Mohamed Sarrab, Hafedh Al-Shihi, Naveen Safia, “Handbook of Mobile Application Development: A Guide to Selecting the Right Engineering and Quality Features”, Bentham Science Publishers, 2021, ISBN :9814998265, 9789814998260.

REFERENCES:

1. Richard Rodger, “Beginning Building Mobile Application Development in the Cloud”, John Wiley & Sons, 2011, ISBN: 1118034694, 9781118034699.
2. Adrian Kosmaczewski, Mobile JavaScript Application Development: Bringing Web Programming to Mobile Devices, O'Reilly Media, 2012, ISBN: 1449327850; 9781449327859.

3. Jeff McWherter, Scott Gowell, Professional Mobile Application Development, Wrox, 2012, ISBN: 1118203909, 9781118203903

COURSE OUTCOMES:

CO1: Develop mobile application using any mobile application development tool.

CO2: Design graphical interface for any mobile application.

CO3: Apply action listeners for the buttons in the mobile application

CO4: Implement database connectivity and web access support for a mobile application.

CO5: Devise a mobile application that uses the concept of multithreading.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2
CO1	H	H	H	H	H	-	-	L	L	L	L	M	H	M
CO2	H	H	M	M	H	-	-	L	M	L	M	M	H	M
CO3	H	H	H	H	H	-	-	L	L	L	L	M	H	H
CO4	H	H	H	M	M	-	-	L	M	L	M	H	H	H
CO5	H	M	M	M	M	-	-	L	L	L	L	L	M	M

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient mobile application Infrastructure, promote thenovel innovation.

Statement:

The holistic understanding of mobile applications and components leads to construction of resilient infrastructure and sustainable industrialization.

GED 3201	REASONING AND APTITUDE FOR ENGINEERS	L	T	P	C
SDG: 4		0	0	2	1

COURSE OBJECTIVES:

COB1: To develop students' critical reading skills

COB2: To foster their writing skills

COB3: To enlighten the various methods of solving quantitative problems

COB4: To make students ready for clearing placement and competitive examination

MODULE I OBJECTIVE ENGLISH 07

Reading Comprehension - Sentence Rearrangement - Cloze Test – Error Spotting

MODULE II VOCABULARY DEVELOPMENT 08

Vocabulary (Synonyms and Antonyms, one word Substitutes, Spellings, Idioms and Phrases, etc) - Fill in the blanks - Paragraph Completion

MODULE III GENERAL MENTAL ABILITY 08

Time speed and Distance –Problems on Trains – Boats and Streams - Permutation and Combination - Probability

MODULE IV QUANTITATIVE ABILITY 07

Data Interpretation (charts, graphs, tables, data sufficiency, etc.) – Time and work-Pipes and Cisterns-Venn Diagrams-Mensuration

P – 30 ; TOTAL HOURS - 30

REFERENCES:

1. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.
2. Swan, Michael (2005). Practical English Usage, Oxford University Press.
3. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
4. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017
5. R. S. Aggarwal , A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand Limited, 2010

6. Khattar Dinesh , The Pearson Guide to Quantitative Aptitude for Competitive Examinations, 3e, Pearson India , 2016
7. Rajesh Verma , Fast Track Objective Arithmetic Paperback , Arihant Publications (India) Limited , 2018
8. Arun Sharma Teach Yourself Quantitative Aptitude Useful for All Competitive Examinations, McGraw Hill Education (India) Pvt. Limited, 2019.

COURSE OUTCOMES:

CO1: Demonstrate their reading ability

CO2: Exhibit their vocabulary and writing skills

CO3: Apply the problem-solving techniques

CO4: Gain confidence mentally and be successful in their career

Board of Studies (BoS) :
13thBoS of the Department of English held on 17.6.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1										M		
CO2										H		
CO3										L		
CO4												M

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG No. 4 : Give Quality Education to all the Engineers

Statement: In future, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

SEMESTER VII

CSD 4101	BLOCKCHAIN TECHNOLOGY	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the basic concepts and purpose for Blockchain.

COB2: To gain knowledge on evolution of crypto currencies like Bitcoin and Ethereum.

COB3: To study the consensus algorithms in cryptocurrency.

COB4:To explore the process of Smart contracts in Blockchain.

COB5: To understand the Blockchain Mining process in various applications.

MODULE I BASICS OF BLOCKCHAIN 9

Concept of Blockchain- History-Definition of Blockchain- Fundamentals of Blockchain -Characteristics of Blockchain - Consensus in Trust-Building - Public, Private, and Hybrid Blockchains - Distributed Ledger Technologies - DLT Decentralized Applications and Databases - Architecture of Blockchain – Transactions - Chaining Blocks - Value Proposition of Blockchain Technology – Decentralized System

MODULE II CRYPTOGRAPHY 9

Bitcoins - Working of Bitcoin - Merkle Trees - Bitcoin Block Structure, Address, Transactions, Network, Wallets,Payments, Clients and Supply.–Ethereum – History - Ethereum Virtual Machine –Working of Ethereum -- Ethereum Clients - Ethereum Key Pairs - Ethereum Addresses - Ethereum Wallets - Ethereum Transactions - Ethereum Languages - Ethereum Development Tools.

MODULE III CONSENSUS 9

Consensus- Approach – Algorithms - De-centralized Consensus - Byzantine Agreement Methods – Consensus attacks – Hashing in Blockchain.

MODULE IV SMART CONTRACTS 9

Smart Contracts - Absolute and Immutable - Contractual Confidentiality - Law Implementation and Settlement – Characteristics - Proofs of Origin - Supply Chain Management - Medical Sciences - Finance - Media and Entertainment - Public Services - Legal Services - Darknet.

MODULE V BLOCKCHAIN MINING AND USE CASES 9

Mining in Blockchain - Bitcoin - Blocks Validation and Identification - Bitcoins Creation - Mining Hardware - Mining Software - Running Miner Software - Executing Several Miners - Bitcoins Management - Reasons for Bitcoin Mining – Swarm - Robotic Possibilities - Sidechain Hopping - Blockchain Forks – Blockchain Usecases and Case Study.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Kumar Saurabh , AshutoshSaxena,"Blockchain Technology: Concepts and Applications", Wiley; First Edition, ISBN-13 : 978-8126557660, 2020.
2. Bashir, Imran,"MasteringBlockchain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing Ltd, ISBN-13 978-1788839044, 2018.

REFERENCES:

1. Antonopoulos, Andreas M., "Mastering bitcoin: Programming the open blockchain." O'Reilly Media, Inc.", ISBN: 9781491954386, 2017.
2. Soze, Keizer. "Blockchain: Mastering Blockchain (Volume 2)." ,Createspace Independent Publisher, ISBN-13 : 978-1974263301, (2017).
3. Ambadas Tulaja, Arshad Sarfraz, Sham M R , "Blockchain for Enterprise Application Developers", Wiley Publications, ISBN 978-81-265-9996-7, 2020.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the purpose of Blockchain in banking and other industries.

CO2: Examine the use of first and second-generation cryptocurrencies.

CO3: Apply the Consensus algorithms to implement blockchain mechanisms.

CO4: Design Smart contracts using blockchain methodologies.

CO5: Investigate mining algorithms and implement in real time applications.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO 1	PSO2
CO1	H	L	L	L				L		L	L	M	H	L
CO2	H	H	M	L			L	L		M	L	M	H	L
CO3	H	M	H	M	H	M		H		L	M	M	H	H
CO4	H	H	H	M	H	M	H	H	H	L	M	M	M	M
CO5	H	H	M	M	M		M	H	H	L	M	M	M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The in-depth knowledge on Blockchain technology enables the future generations for newer innovations in worldwide secure digital transactions.

CSD 4102	INTERNSHIP II	L	T	P	C
SDG: 9		0	0	0	1

COURSE OBJECTIVES:

COB1: To understand career alternatives in Computer Science domain prior to graduation.

COB2: To assess interests and abilities in their field of study.

COB3: To expose towards the industrial experience.

COB4: To appreciate work and its function in the Economy.

COB5: To explore employment and business contacts in the software and hardware industry

GUIDELINES:

- The students shall undergo industry training in any industry relevant to the field study or internship at research organizations / eminent academic institutions for the minimum period of 15 days during the summer vacation of third year.
- In any case, the student shall obtain necessary approval from the Head of the Department / Dean of School and the training has to be taken up at a stretch.
- In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department.
- The student shall also submit an internship completion certificate issued by the industry / research / academic organization.
- The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.
- The credit will be awarded in the 7th Semester.

COURSE OUTCOMES:

The students who complete Internship will be able to

CO1: Integrate theory and practice in the field of Computer Science

CO2: Extend work habits and attitudes necessary for job success.

CO3: Develop communication, interpersonal, ethical and other critical skills in the job interview process.

CO4: Acquire directly a full-time job in Software/Hardware Industry with the help of Industry training experience.

CO5: Become a successful entrepreneur and benefit society with new ideas and innovations using computer technology.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H	H	H	H		L		M	M	M	M	H	M
CO2	L		H	M	M	H	H	M	M	H	H	H	L	H
CO3	L		H	M	M	H	H	H	M	H	H	H	M	H
CO4	M	M	M	H	H	L	M	M	H	H	H	H	M	H
CO5	L	M	M	H	M	L	M	M	H	H	H	H	M	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement : The student acquire industrial and business experience through internship and can promote new and innovative ideas in the work place after graduation. Also the course enables the students to become a successful entrepreneur in their field of study.

SEMESTER VIII

CSD 4201	**PROJECT WORK**	**L**	**T**	**P**	**C**
SDG: 4,9		**0**	**0**	**18**	**9**

COURSE OBJECTIVES:

COB1: To explore the team sprits among the students

COB2: To investigate the real time problems related to industries

COB3: To provide knowledge on the different algorithms and techniques

COB4: To learn the different testing tools to analyze the results

COB5: To inculcate the presentation skills and write effective reports

PROCEDURE

The students may do their project as an individual or as a team of two to three students. A committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations.

COURSE OUTCOMES:

CO1: Explore various algorithms and scrutiny relevant knowledge within the domain for the specified problem defined.

CO2: Examine the problem based on constraint and information.

CO3: Design and plan the implementation of the algorithm for given problem satisfying the functional requirements, adhering to the limitations.

CO4: Evaluate and critically assess results based on the testing strategy adaptable to the domain.

CO5: Document the process with the results obtained with the prescribed format.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	M	M	M	H	H	L	H	H	H	H
CO2	H	H	H	M	M	M	L	H	H	L	H	H	H	H
CO3	H	H	H	M	M	M	M	H	H	L	H	H	H	H
CO4	M	M	M	M	M	M	M	H	H	M	H	M	H	H
CO5	M	M	M	M	M	M	M	H	H	H	H	M	H	H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG No. 4: Quality Education: Ensuring inclusive and equitable quality education for all persons

Statement: By doing projects using engineering solutions, will enable students to gain quality educations.

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Student doing projects in multiple domains will promote industrialization and foster innovation.

PROFESSIONAL ELECTIVES – IV SEMESTER

CSDX 201	DIGITAL TRANSMISSION	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES :

COB1: To introduce the fundamental components of digital transmission system.

COB2: To acquire knowledge on digital modulation techniques.

COB3: To understand the working principles of digital systems.

COB4: To explore the importance of synchronization in digital transmission.

COB5: To study the performance of digital communication systems.

MODULE I BASIC TERMINOLOGIES AND BASEBAND TRANSMISSION 11

Principles of System Design – Analog to Digital Conversion Techniques – Modulation and Multiplexing Techniques - Baseband Transmission – Binary Coding – Power Spectral Density – Error Performance – Pulse Shaping and Inter Symbol Interference – Multilevel Baseband Transmission – Partial Response coding – Eye Patterns – Equalization – Data Scrambling Techniques.

MODULE II DIGITAL TRANSMISSION 09

Digital Modulation Techniques – ASK- FSK – BPSK – Comparison – M-ary FSK – M-ary PSK – Quadrature Amplitude Modulation – Offset QPSK – Minimum Shift Keying – Quadrature Partial Response – Digital Transmission – Telephone Networks – FDM – Transmission Parameters – Conditioning – Voice Band Modems- Wideband Modems – Transmultiplexers – Hybrid Transmission Systems.

MODULE III DIGITAL SYSTEMS 10

Digital Cable Systems – Introduction – Characteristics – Regenerative Repeaters – Clock Recovery and Jitter – Crosstalk – Error Performance – Repeater Spacing – Implementation – Digital Radio Systems – Line of Path Propagation – Multipath Fading – Frequency Allocation – Interference Effects – Digital Radio Design – Radio Link Calculation.

MODULE IV NETWORK TIMING AND SYNCHRONIZATION 08

Time Standards – Frequency Sources – Clocks – Synchronization Techniques – Dissemination Systems: Time, Frequency – Synchronization Schemes – Transmission System – Testing Techniques.

MODULE V MONITORING AND CONTROL 07

Performance Monitoring – Fault Isolation – Monitoring and Control System – Future of Digital Transmission – New Digital Services – Technology – Transmission in Local Areas – ISDN.

L – 45;TOTAL HOURS-45

TEXT BOOKS:

1. David R.Smith, “Digital Transmission Systems”, Springer, 4th Edition, ISBN 978–1–4757-1187-5, 2013.
2. Proakis, John G. “Digital Communications”, 4th ed. New York, NY: McGraw-Hill, ISBN: 9780072321111, 2000.
3. Herbert Taub. Donald L Schiling, Goutam Sana, “Principles of communication systems”, 3rd Edition,McGraw-Hill, ISBN: 1259029859, 2008.
4. Sam Shanmugam, “Digital and Analog Communicator Systems “, John Wiley, ISBN:9788126536801, 2005.

REFERENCES:

1. Simon S. Haykin, “Digital Communication Systems”, Wiley Publications, ISBN 978-0-471-64735-5, 2013.
2. Rao, Ramakrishna P,”Digital Communication”, McGraw Hill,Delhi, ISBN 9780070707764, 2011.
3. Sklar, Bernald, “Digital Communication”, Pearson Education India, Delhi,Second Edition, ISBN: 9781292026060,2014.

COURSE OUTCOMES :

After completion of the course, students should be able to

CO1: Describe the components and their functions in communication systems.

CO2: Compare and contrast the modulation techniques applied to digital transmission systems.

CO3: Provide a comprehensive understanding of the digital system..

CO4: Identify the testing techniques related to network timing and synchronization.

CO5: Analyze the performance of digital communication systems

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				M		H						H		
CO2			L				M							
CO3	H							H						
CO4	H		H				H		H				H	
CO5		L					H							H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The overall Knowledge of operations and issues associated with digitization and information transmission: sampling, encoding, quantization, distortion, channel capacity, and matched filtering ensures secure digital transmission in various industries.

CSDX 202	CELLULAR AND WIRELESS NETWORK	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn about the challenges and opportunities of cellular networks.

COB2: To provide knowledge on capacity and coverage analysis of relay node.

COB3: To get familiar with evolution of wireless networks standards such as IEEE 802.16, blue tooth and 3G.

COB4: To expose the Universal Mobile Transmission Services architecture and its functions..

COB5: To comprehend wireless standards such as CDMA 2000 & WiMax.

MODULE I CELLULAR NETWORKCHALLENGES 09

Introduction – LTE-A – Cooperative relaying – Concept of Relay Node - Relay classification – Relay Node – RN enhance cellular Network – RN mode operation in LTE-A – RN planning in cellular network – Moving Relay.

MODULE II CAPACITY AND COVERAGE ANALYSIS FOR MULTI HOP RELAY 09

Introduction – Channel interference – Network capacity without RN – Handover process analysis - Network capacity with RN – Optimum RN location – Optimum number of relays – Pseudo code of RN deployment – Frequency reuse for multi hop relay – Enhance relay link capacity – System modeling – Balance transmission power for MR.

MODULE III WIRELESS NETWORKS BASICS 09

Evolution of mobile communications – fundamentals – mobile data – WiFi – Bluetooth – Cable systems – Wireless migration options – Harmonization process – Overview of 3G networks.

MODULE IV UNIVERSAL MOBIL TELECOMMUNICATION SERVICES (UMTS) 09

Introduction – UMTS basics – WCDMA air interface – UTRAN architecture – Establishment of UMTS Speech Call – UMTS packet data – High Speed Packet data – Handover – HSPA connection establishment.

MODULE V CDMA 2000 and WiMax 09

Radio and network components – Network structure – Packet Data transport process flow – Radio network – WiMax standards – Generic WiMax Architecture – Core Network – Radio Network Modulation –Applications.

L – 45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Abid Yahya , “LTE-A Cellular Networks: Multi-hop Relay for Coverage, Capacity and Performance Enhancement”, Springer, ISBN : 3319433040, 2016.

REFERENCES:

1. Clint Smith, Daniel Collins, “Wireless Networks”, McGrawHill Education, 3rd edition, ISBN-10: 9339218159, ISBN-13: 978-9339218157, 2014.
2. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, ISBN 10: 0124051626, 9780124051621, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Summarize the opportunities and challenges of cellular networks.

CO2: Analyze the capacity and coverage problem with multi hop relay.

CO3: Describe the characteristics of wireless communication standards like WiFi, Bluetooth and 3G networks.

CO4: Illustrate the working of Universal Mobile Telecommunication Services.

CO5: Demonstrate the architecture of CDMA 2000 and WiMax in real time applications.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	H		H						M					
CO2	M												H	
CO3			M	H									H	H
CO4				H			M		H			H		
CO5								L						

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The learner is able to work with decision-makers to improve the uptake of sustainable infrastructure (including internet access).

CSDX 203	DESIGN OF COMPUTER NETWORK SERVICES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1 : To learn multimedia services delivered over the Internet.

COB2 : To gain knowledge about various QoS and QoE measures for audio and video streams.

COB3 : To explore the protocols for SIP and IMS for setting up multimedia services.

COB4 : To study the various architectures and protocols to provide QoS guarantees in the IP network.

COB5 : To understand new network design architectures adoptable in future.

MODULE I BASICS OF NETWORK SERVICES 9

Network services basics - Process-Services: Definition, Characteristics and Frameworks-IT infrastructure Library-Process Modeling - Process design patterns - Example using BPMN.

MODULE II QUALITY OF SERVICE & QUALITY OF EXPERIENCE 9

QoS measures- Subjective evaluation of voice and video quality- Objective evaluation of audio and video quality - Session initiation protocol(SIP) - Format of a SIP message- SIP response messages - SIP methods-Session description protocol - Examples of SIP messages - Locating SIP servers.

MODULE III IP MULTIMEDIA SUBSYSTEM 9

IMS entities and functionalities - User identification - Setting up a session in IMS -Service provision - Setting up an emergency IMS session - SIP compression - Networking Services over IMS - Multimedia Service Continuity-VPN.

MODULE IV QOS ARCHITECTURES IN THE TRANSPORT NETWORK 9

Connection-oriented networks - MPLS architecture - DiffServ architecture - MPLS support for DiffServ - Label distribution protocol - Resource reservation protocol- The resource reservation protocol-traffic engineering (RSVP-TE).

MODULE V NEW NETWORK DESIGN 9

New IP: Enabling next wave of networking innovation – Collaborative network towards application aware networking- Content delivery networks – Green for ICT,Green by ICT ,Green by Design.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Harry Perros, Networking Services QoS, Signaling, Processes, Create space Independent Publications, ISBN: 1495437485, 978-1-49- 543748-9, 2014.
2. Christian Jacquenet," Design Innovation and Network Architecture for the Future Internet", ISBN: 9781799876472, Engineering Science Reference,2021.

REFERENCES:

1. Peterson, Larry L., and Bruce S. Davie, Computer networks: a systems approach, Elsevier, ISBN:978-0-12-374013-7, 2012.
2. Jin, Cheng, Jamin Sugih, Danny Raz, and Yuval Shavitt, Building scalable network services: theory and practice, Springer Science & Business Media, ISBN: 978-1-44-198897-3, 2011.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify the attributes that impact the network services.

CO2: Assess the QoS and QoE measures of audio and video streams.

CO3: Summarize the functionalities of IP multimedia subsystem.

CO4: Compare the different Qos architecture along with their protocols.

CO5: Analyze new innovative network design for future.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		L		M	L					L			L	
CO2						M		L						L
CO3					L								L	
CO4					L	M						M		
CO5	M		H	M			M	M	L	M	M		M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning the course , the students are able to design innovative network infrastructure providing stream less services.

CSDX 204	SCRIPTING LANGUAGES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basics in JavaScript programming.

COB2: To understand the object models and event handling in JavaScript.

COB3: To acquire knowledge on dynamic client side scripting.

COB4: To impart knowledge on operations in PHP.

COB5: To provide the knowledge and ability to write scripts using PHP to dynamically generate HTML code.

MODULE I INTRODUCTION TO JAVASCRIPT 9

Introduction to JavaScript: adding JavaScript to XHTML documents-Usage considerations-History and uses of java script- Core language features: Variables- basic data types-Composite types: objects, arrays, functions-Expressions-flow control-Loops.

MODULE II OBJECT MODELS AND EVENT HANDLING 7

JavaScript regular expressions: RegExp object-String methods for Regular expressions-Advanced regular expressions – Limitations - Object model-Document object - simple event handling-Standard document object model-Event Handling.

MODULE III APPLIED JAVASCRIPT 10

Windows, frames, overlays - Form handling - User interface elements - Ajax and remote JavaScript-Browser management - Media management-Trends and practices-writing quality code – Security - Security policy - Performance.

MODULE IV FUNDAMENTALS OF PHP 10

Introduction-simple PHP program-Converting between data types-Arithmetic operators-Initializing and manipulating arrays-String comparisons-String processing with regular expressions-Reusing code and writing functions.

MODULE V OBJECT ORIENTED PHP AND WEB APPLICATION SECURITY 9

Object Oriented PHP-Error and exception handling-Form processing and business logic-Reading from a database-Cookies-Dynamic content-Web application security risks-Building a secure web application-Implementing

authentication methods with PHP. Interacting with file system and server-network and protocol functions-Session control-Integrating java script and PHP

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition,London, ISBN:9780072253573, 2013.
2. Harvey Deitel, Paul Deitel, Abbey Deitel,”Internet and World Wide Web How To Program”, fifth edition, Pearson Education, ISBN: 13:978-0-273-76402-1, 2012.

REFERENCES:

1. David Flanagan, “JavaScript: The Definitive Guide”, Sixth Edition,O'Reilly Media, ISBN: 978-0-596-80552-4, 2012.
2. Luke Welling, Laura Thomson,” PHP and MySQL Web Development”, fifth edition, Addison Wesley, ISBN: ISBN 13: 9780321833891, 2016.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Implement JavaScript programs with simple and composite data types.

CO2: Write simple JavaScript code to automate system administration tasks and rapidly develop simple applications using object models and event handling mechanisms.

CO3: Design client side validation using JavaScript.

CO4: Create patterns and evaluate it using PHP script.

CO5: Implement the authentication methods to enable security for the web application.

Board of Studies (BoS) :

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO1 2	PSO 1	PSO 2
CO1	M	L	H	L	M	-	-	L	L	L	M	L	M	M
CO2	M	L	H	L	M	-	-	L	L	L	M	L	M	M
CO3	L	L	L	L	L	-	-	-	L	-	-	-	M	-
CO4	L	L	L	L	L	-	-	-	L	-	-	-	M	-
CO5	M	L	H	L	M	-	-	L	H	L	M	L	M	M

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 :Build infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Scripting language's flexibility has allowed developers to create innovative software. Most engineering students were required to learn the scripting languages to promote their study and complex problem solving in order to keep up-to - date with the competition.

CSDX 205	INFORMATION RETRIEVAL	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the retrieval process of information retrieval system.

COB2: To introduce the taxonomy and characteristic of information retrieval models.

COB3: To learn indexing methods for improving the performance of an information retrieval system.

COB4: To acquire knowledge on retrieving web page contents.

COB5: To explore the text mining techniques.

MODULE I INTRODUCTION 8

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine. .

MODULE II MODELLING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.

MODULE III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations - Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

MODULE IV SEARCHING THE WEB 10

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries.

MODULE V DOCUMENT TEXT MINING 9

Information filtering - organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Manning Christopher D., RaghavanPrabhakar, “Introduction To Information Retrieval”, Cambridge University Press; First edition, ISBN-13: 978-1107666399m, 2008.

REFERENCES:

1. Ricardo Baeza – Yates, BerthierRibeiro – Neto, “Modern Information Retrieval: The concepts and Technology behind Search” (ACM Press Books), Second Edition, ISBN 10: 0321416910, 2011.
2. Stuart Russell-Peter Norvig, "Artificial Intelligence - A Modern Approach", 3rd Edition, Pearson Education, ISBN-10: 0-13-604259-7, 2009
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, ISBN-10: 0136072240, 2009.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the techniques of Information Retrieval systems**.**

CO2: Provide a framework and system of resources for building IR models in search engines.

CO3: Apply the information retrieval indexing techniques in web applications.

CO4: Analyse the contents of a web page using web crawling and indexing.

CO5: Apply text mining techniques in search engines.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1						H								
CO2			H											
CO3		M												M
CO4					H									
CO5	L	L				M							H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Information retrieval can provide organizations with immediate value-while it's important to try to figure out ways to capture tacit knowledge, information retrieval provides a means to get the information that already exists in electronic formats.

CSDX 206	MULTIMEDIA DESIGN PROGRAM	L	T	P	C
SDG:9		3	0	0	3

COURSE OBJECTIVES :

COB1: To learn the basic operations in Adobe flash workspace.

COB2: To get familiar with tools and methods for drawing of objects.

COB3: To explore working of symbols and interactions in Flash.

COB4: To provide understanding of animations and special effects.

COB5: To impart knowledge on interactive application development using flash.

MODULE I UNDERSTAND THE FLASH WORKSPACE 8

Open a Document and Playa Flash Movie- Create and Save a Flash Movie - Work with the timeline - Distribute a Flash Movie Application.

MODULE II DRAWING OBJECTS IN ADOBE FLASH 9

Use the Flash Drawing and Alignment Tools- Select Objects and Apply Colors - Work with Drawn Objects - Abik with Text and Text Objects - Work with layers and Objects.

MODULE III WORKING WITH SYMBOLS AND INTERACTIVITY 9

Create Symbols and Instances- Work with libraries - Create Buttons - Assign Actions to Frames and Buttons -Import Graphics.

MODULE IV CREATING ANIMATIONS AND SPECIAL EFFECTS 10

Create Motion Tween Animations- Create Classic tween animation - Create Frame-by-Frame Animations -Create Shape tween Animations - Create Movie Animate Text - Create A Mask Effect - Add Sound - Add Video - Create an Animated navigation Bar - Create Character Animations Using Inverse Kinematics - Create 3D Effects - Use the Deco Tool.

MODULE V PREPARING AND PUBLISHING APPLICATIONS 9

Publish Movies Using Different formats – Reduce file Size to Optimize a Movie - Create a Preload& - Publish AIR Applications -Create and Publish Applications for Mobile Devices.

L – 45;TOTAL HOURS– 45

TEXT BOOKS:

1. James Shuman,"Adobe Flash CS6 (Revealed)",Course Technology Ptr (Sd), ISBN : 978-1133693215,2012.
2. Joseph Labrecque,"Learning Adobe Edge Animate", Packt Publishing,1st edition, ISBN: 1849692424, 2012.

REFERENCES:

1. William Sanders,"Learning PHP Design Patterns", Shroff/O'Reilly; First edition, ISBN-10: 935110060X, ISBN-13: 978-9351100607, 2013.
2. Vic Costello,"Multimedia Foundations" Focal Press ,1st edition, ISBN10: 0240813944, ISBN-13: 978-0240813943,2012.

COURSE OUTCOMES :

After completion of the course, students should be able to

CO1: Describe the basic operations in Adobe flash workspace.

CO2: Illustrate various tools for drawing of objects.

CO3: Design simple media applications with symbols and interactions.

CO4: Apply animation techniques and special effects in media applications.

CO5: Develop flash applications for desktops and mobiles.

Board of Studies (BoS) : **Academic Council:**

22nd BoS of CSE held on 17.08.2023 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L													
CO2		M					M		L					
CO3		H			H			H						
CO4						M			M				H	
CO5									H	L				

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Implement effective design, production and testing techniques (including appropriate project engineering and management) through all phases of game development as relevant to programmers/engineers

CSDX 207	**SOUND EDITING AND PROCESSING**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To learn the basics of audio processing and sound generation.

COB2: To gain the knowledge of signals and audio processing.

COB3: To explore the basic concepts of speech.

COB4: To understand the principles of psychoacoustic processing and modelling.

COB5: To explore the auditory perception and digital reproduction process.

MODULE I INTRODUCTION TO SOUND AND SPEECH 9

Basic audio processing - Normalization - Continuous audio processing - Visualization - Sound generation - The human voice - characteristics of speech – types of speech.

MODULE II BASIC AUDIO PROCESSING 9

Sound in MATLAB - Normalization - Continuous audio processing- Segmentation - Analysis window sizing - Visualization - Sound generation.

MODULE III THE HUMAN VOICE AND AUDITORY SYSTEM 9

Speech production - Characteristics of speech - Types of speech - Speech understanding - Physical processes - Perception - Amplitude and frequency models.

MODULE IV PSYCHOACOUSTICS AND COMMUNICATIONS 9

Psychoacoustic processing - Auditory scene analysis - Psychoacoustic modeling - Hermansky - style model - MFCC model - Masking effect of speech - Quantization - Parameterization - Pitch models - Analysis- Perceptual weighting.

MODULE V STUDIO ACOUSTICS AND DIGITAL AUDIO TECHNOLOGY 9

The Basics of Sound - Waveform Characteristic - Auditory Perception - Studio Types - Frequency Balance - Acoustic Echo Chambers - Power- and Ground-Related Issues - The Basics of Digital Audio - Digital Reproduction Process - Digital Audio Recording Systems - Hard Disk Recording.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Ian Vince McLoughlin “Speech and Audio Processing: A MATLAB based Approach”, Cambridge University Press, First edition, USA, ISBN: 1107085462, 2016.
2. David Miles Huber, Robert E. Runstein,”Modern Recording Techniques (Audio Engineering Society Presents), Focal Press, Eighth edition, USA, ISBN-13: 978-0240821573, 2013.
3. Michael Talbot-Smith “Sound Engineering Explained”, Focal Press, Second edition, USA, ISBN: 0240516672, 2012.

REFERENCES:

1. Wallace Jackson, “Digital Audio Editing Fundamentals”, Apress publisher, First Edition, Lompoc, California, USA, ISBN-13 : 978-1-4842-1647-7, 2015.
2. Nelson Morgan Ben Gold, “Speech and Audio Signal Processing: Processing and Perception of Speech and Music”, Willey publication, Second Edition, USA, ISBN-13 : 978-8126508228, 2006.
3. http://eemedia.ee.unsw.edu.au/contents/elec9344/LectureNotes/
4. https://www.bridgeacademy.in/training/Sound-Engineering-Course.php.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the basic concepts of audio theory and musical acoustics.

CO2: Interpret the specifications of audio processing.

CO3: Illustrate the concepts of speech production.

CO4: Develop psychoacoustics model and communication analysis.

CO5: Apply sound acoustics and basic video recording skills.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1						L		M						M
CO2							M							
CO3													M	
CO4							M							
CO5					H			L						H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9:Construct flexible Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The elite virtual infrastructure could be attained with the advanced sound editing technology.

CSDX 208	MULTIMEDIA APPLICATION DEVELOPMENT	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1:To learn the various building blocks of multimedia application.

COB2: To provide the basic scripting concepts used in multimedia applications.

COB3: To explore the functions of the multimedia skill in the software industry.

COB4: To understand the importance of compression and the compression techniques used in Multimedia application development.

COB5: To expose the various networking concepts used in Multimedia network.

MODULE I FUNDAMENTAL CONCEPTS 09

Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video. Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

MODULE II ACTIONSCRIPT 09

ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class - Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

MODULE III APPLICATION DEVELOPMENT 09

An OOP Application Frame work, Using Components with ActionScript MovieClip Subclasses.

MODULE IV MULTIMEDIA DATA COMPRESSION 09

Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT)- Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

MODULE V MULTIMEDIA NETWORKS 09

Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand(MOD).

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Drew, Mark S.., Liu, Jiangchuan., Li, Ze-Nian. Fundamentals of Multimedia. Germany: Springer International Publishing, ISBN:9783319052908,2014.
2. Havaldar, Parag., Medioni, Gerard. Multimedia Systems: Algorithms, Standards, and Industry Practices. Italy: Cengage Learning, ISBN:9781418835941,2009.

REFERENCES:

1. Colin Moock, Essential ActionScript 3.0, 1st Edition, SPD O'Reilly, ISBN: 978-0-596-52694-8, 2007.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify the components for building the multimedia blocks.

CO2: Use appropriate multimedia elements for the given applications.

CO3:Apply the functions of multimedia skill in the software industry.

CO4: Choose an appropriate compression mechanism for particular application.

CO5: Set up a multimedia network for the given real time scenario.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		L												
CO2	L												M	
CO3		M												M
CO4			H											
CO5			H		M									H

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning this course, the student may be able to create and transform multimedia application and in turn promote Industrial growth and foster innovation.

CSDX 209	**SOFTWARE DESIGN AND ARCHITECTURE**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide an insight to all elements of architectural design and implementation of software systems

COB2: To understand Architectural styles and Quality Attributes.

COB3: To acquire knowledge on fundamental design principles, methods, patterns and strategies in the creation of a software system and its supporting documents

COB4: To study the role of various software architectures and styles.

COB5: To explore common tools and terminology related to software architecture

MODULE I INTRODUCTION TO SOFTWARE ARCHITECTURE 9

Notion of Architecture – Architectural Structures and views – Architectural Patterns- Good Architecture-Importance of Software Architecture –Contexts of Architecture.

MODULE II QUALITY ATTRIBUTES 9

Architecture and Requirements-Functionality-Quality Attribute considerations and requirements – Achieving Quality Attributes through Tactics – Other Quality Attributes – Architectural Tactics and Patterns – Case Studies.

MODULE III ARCHITECTURAL STYLES 9

Architectural styles - Pipes and filters - Data abstraction and object-oriented organization - Event-based, implicit invocation - Layered systems – Repositories – Interpreters - Process control - Other familiar architectures - Heterogeneous architectures.

MODULE IV SOFTWARE DESIGN 9

Nature of the design process - Design in the Software Development Process – Design qualities - Describing a Design Solution - Design Representations.

MODULE V DESIGN PATTERNS 9

Design Processes and Design Strategies – Design Patterns – Design Practices – Design with objects – Design practices for object oriented paradigms – Case Studies.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Len Bass, Paul Clements, Rick Kazman, “Software Architecture in Practice”, Pearson Education, Third edition, 2015.
2. Mary Shaw and David Garlan,” Software Architecture- Perspectives on an Emerging Discipline”, Prentice Hall,2007.

REFERENCES:

1. Humberto Cervantes, Rick Kazman“Designing Software Architectures: A Practical Approach “, Addison-Wesley Professional, First Edition,2016
2. DavidBudgen," SoftwareDesign”, AddisonWesley, Second Edition 2012.

COURSE OUTCOMES:

CO1: Identify the different types of architectures and outlinethe importance of software architectures.

CO2: Examine the quality attributes of the architecture chosen

CO3: Select and use appropriate architectural styles and adopt different architectural styles for designing a system.

CO4: Apply the software design principles to design real time applications and identify criteria for the design of a software system.

CO5: Select and use appropriate software design patterns.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			M	H										
CO2				H			M							
CO3					H		L							M
CO4	M			H								L	H	
CO5	M				H	L								

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG No. 9

Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement:The comprehensive understanding of different software design and architecture concepts, criteria, attributes and design patterns provides way for the development of innovative software that may suit the needs of the industry and society.

CSDX 210	**SOFTWARE CONFIGURATION AND**	**L**	**T**	**P**	**C**
SDG: 9	**RISK MANAGEMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1 : To study the importance of integrity and control of system components throughout SDLC.

COB2 : To understand the configuration control in SCM.

COB3 : To learn about the SCM tools and its implementation.

COB4 : To expose the various risk levels in software development.

COB5 : To explore a concise view on the risk plan and highlight the techniques in identifying risks.

MODULE I INTROCUCTION 9

Overview and Pitfalls in SDLC – Importance of SCM – Basic concepts – Configuration Identification.

MODULE II CONFIGURATION CONTROL 9

Configuration control – Defect Classification – Defect controls – Status Accounting – Verification and Audits – CMM.

MODULE III SCM TOOLS 9

Introduction – SCM Tools Evolution – Advantages – Functions – Tools Selection – Documentation Management- SCM Implementation – Phases of SCM Implementation – SCM and Cloud Computing – Code Repositories – Operations on SCM system.

MODULE IV RISK MANAGEMENT PROCESS 9

Introduction to software risk management-objectives and goals-assessment-costdeveloping a software risk management strategy-Risk management paradigmcultural considerations.

MODULE V RISK ASSESSMENT, MITIGATION AND MONITORING 9

Discovering risks-Methods-classification of risks-risk taxonomy-reviews-Risk assessment approaches-tools and techniques- risk planning-risk mitigation strategies- formulating and implementing risk management plans-risk databasemanaging and tracing risk.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Alexis Leon, "Software Configuration Management Handbook", Artech House, Third Edition, ISBN 978-1-60807-843-1, 2015.
2. John McManus, “Risk Management in Software Development Projects”, Route Ledge, ISBN: 1136367918, 9781136367915 ,2012.

REFERENCES:

1. Maria E Moriera, “Software Configuration Management Implementation
2. Roadmap", John Wiley &Sons , ISBN 0-470-86264-5, 2004.
3. Tom DeMarco, Tim Lister, Waltzing with Bears: Managing Risk on Software Projects, Addison-Wesley, ISBN 0133492230, 9780133492231, 2013.
4. Hall, Elaine M.” Managing Risk: Methods for Software Systems Development”, Addison Wesley, ISBN 0201255928, 2001.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the fundamentals of the SDLC and SCM.

CO2: Analyze the defects and configure the SCM.

CO3: Identify the SCM tools for implementing in SDLC

CO4: Develop a comprehensive risk management plan for a project.

CO5: Implement qualitatively and quantitatively analyze risks, assess risks and the risk mitigation strategies.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO 1	PSO 2
CO1	M	L	L	L	M	M	-	-	H	M	L	H	H	M
CO2	H	M	L	L	H	H	M	H	H	H	L	M	H	H
CO3	H	H	L	L	M	M	L	M	H	M	M	H	H	M
CO4	L	M	H	H	L	L	L	L	H	L	H	L	M	L
CO5	L	L	M	M	L	L	L	L	H	L	L	L	M	L

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement : The students will be able to mitigate the challenges and risks faced in software industry.

CSDX 211	INFORMATION ETHICS AND VISUALIZATION	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the importance of ethics in Information and Computer Sciences.

COB2: To expose the various security threats and cyber-attacks.

COB3: To learn about the intellectual property and privacy laws.

COB4: To introduce the fundamental knowledge for information visualization

COB5: To study the 2D and 3D interactive visualization representations.

MODULE I OVERVIEW OF ETHICS 9

Definition of Ethics - Importance of Ethics - Difference between Morals, Ethics and Laws – Ethics in the business world –Corporate social responsibility –Importance of good Business Ethics – Improving Business Ethics - Ethical considerations in decision making – Ethics for IT professionals and IT users.

MODULE II CYBER ATTACKS AND CYBER SECURITY 9

Threat Landscape – Types of Exploits – Federal laws for prosecuting Computer Attacks – CIA Security Triad – Response to Cyber Attack – Computer Forensics.

MODULE III INTELLECTUAL PROPERTY AND PRIVACY LAW 9

Privacy protection – Information privacy – Key privacies – Anonymity Issues – Freedom of Expression – First Amendment Rights – Key Issues – Intellectual Property – Copyrights – Patents – Current Intellectual Property Issues.

MODULE IV INFORMATION VISUALIZATION 9

Introduction to Information Visualization – Explorative Analysis – Confirmative Analysis – Data to Wisdom - Mental models – Scientific Visualization – Criteria for Good Visual Representations.

MODULE V CREATING AND EVALUATING VISUAL REPRESENTATION **9**

Creating Visual Representation – Reference Model – Designing a Visual Application – Visual representation of Linear data – 2D vs 3D – Evaluating Visual Representations – Analytic Methods – Empirical Methods.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. George W. Reynolds, “Ethics in Information Technology”, Cengage Learning, 6th Edition, ISBN-13: 978-1337405874, 2019.
2. Riccardo Mazza, “Introduction to Information Visualization”, Springer, ISBN: 978-1-84800-219-7, 2009.

REFERENCES:

1. Toni Samek and Lynette Shultz, “Information Ethics Globalization and Citizenship“, McFarland & Company, (ISBN: 9781476667720), 2017.
2. Colin Ware, “Information Visualization: Perception for Design”, Morgan Kaufmann, an imprint of Elsevier, Third edition, (ISBN:978-0123814647), 2012.
3. Robert Spence, “Information Visualization: Design for Interaction”, Pearson Publishers, Second Edition, (ISBN: 978-0132065504, 2007.
4. Andreas Kerren, John Stasko, Jean-Daniel Fekete and Chris North, “Information Visualization: Human-Centered Issues and Perspectives”, Springer Edition, ISBN:978-3540709558, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Differentiate between Morals, Ethics and Laws

CO2: Identify the Federal laws for prosecuting Computer Attacks in the information field

CO3: Assess the intellectual property and privacy law.

CO4: Design and build criteria for good visual representations

CO5: Evaluate information visualization and represent the Linear data

Board of Studies (BoS) :	**Academic Council:**
22nd BoS of CSE held on 17.08.2023	21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	L	H	M	M	H	L	-	H	H	H	H
CO2	M	H	L	L	M			H	L	-	M	L	H	M
CO3	L	M	H	H	L	H	H	H	M	-	L	L	H	L
CO4	L	M	H	H	L			H	H	-	M	L	H	M
CO5	M	L	L	L	M			H	H	-	M	H	H	M

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement : The holistic understanding of ethics defines work as a conscious, purposeful human activity indulging lifelong learning

CSDX 212	C# AND .NET	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basic programming in C# and ,NET.

COB2: To acquire skills in writing Windows applications, ADO.NET

COB3: To familiarize the concepts of class libraries.

COB4: To understand the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET.

COB5: To impart knowledge in mobile applications using .Net compact k.

MODULE I C# LANGUAGE BASICS 9

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers.

MODULE II C# ADVANCED FEATURES 9

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

MODULE III BASE CLASS LIBRARIES AND DATA MANIPULATION 9

Diagnostics -Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML- SAX and DOM – Manipulating files and the Registry- Transactions – ADO.NET- Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation.

MODULE IV WINDOW BASED APPLICATIONS, WCF AND WWF 9

Window based applications – Core ASP.NET- ASP.NET Web forms - Windows Communication Foundation (WCF)- Introduction to Web Services – .Net Remoting – Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows

MODULE V .NET FRAMEWORK AND .NET COMPACT FRAMEWORK 9

Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunneling Events- Reading and

Writing XAML - .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner- Professional C# 2012 and .NET 4.5, Wiley, ISBN -13: 978-1118314425, 2012.
2. Harsh Bhasin, —Programming in C#, Oxford University Press, ISBN-13 : 978-0198097402, 2014.

REFERENCES:

1. IanGariffiths, Mathew Adams, Jesse Liberty, Programming C# 4.0, OReilly, Fourth Edition, ISBN: 9780596159832, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, ISBN: 978-1-4302-4234-5, 2012.

COURSE OUTCOMES:

CO1: Demonstrate the knowledge of object-oriented concepts
CO2: Implement string manipulation, events and exception handling within .NET application environment.
CO3: Develop and manipulate GUI components using .NET Components.
CO4:Design various applications using C# Language in the .NET Framework.
CO5:Identify and resolve problems (debug /trouble shoot) in C#.NET window based application

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	L	H			L	L	L	H	L	H	M
CO2	H	M	M	L	M			L	L	-	M	L	H	M
CO3	H	M	H	H	L			L	H	M	L	L	H	L
CO4	H	M	H	H	L			L	H	-	M	L	H	M
CO5	H	L	M	L	M			L	M	L	M	L	H	M

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement :The learner able to understand code solutions and compile C# projects within the .NET framework and to develop professional console and window based .NET application

SEMESTER – V

CSDX 101	**QUEUING THEORY**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the modeling and mathematical skills for a network design.

COB2: To gain knowledge on Markovian Queuing systems and its models

COB3: To learn the queuing networks and its process.

COB4: To expose communication system tools for simulating and analyzing the Queuing systems.

COB5: To explore the design issues and measure the performance of the Queuing systems.

MODULE I INTRODUCTION 7

Basic System Elements - Problems in a Queuing System - Probability Distributions as Models - Identification of Models - Distribution Selection - Basic Concepts in Stochastic Processes.

MODULE II MARKOVIAN QUEUING SYSTEMS 9

A General Birth and Death Queuing Model - The Queue M/M/1 - The Queue M/M/s - The Finite Queue M/M/s/K - The Infinite Server Queue M/M/∞ - Finite Source Queues - Other Models - Imbedded Markov Chains - The Queue M/G/1 - The Queue G/M/1 - Extended Markov and Renewal Models.

MODULE III QUEUING NETWORKS 10

The Markovian Node Network - Queues with Blocking - Open Jackson Networks - Closed Jackson Networks - Cyclic Queues - Matrix-Analytic Queuing Models - Phase Type Distributions - Markovian Arrival Process - Analysis of Queuing Models Using MAM – The Queue G/G/1 and Approximations - Bounds for Mean Waiting Time - Little‘s Law L = λW– Approximations.

MODULE IV STATISTICAL INFERENCE AND COMMUNICATION SYSTEMS 10

Birth and Death Process Models - Imbedded Markov Chain Models for M/G/1 and G/M/1 - The Queue G/G/ 1. Modeling Computer Systems - Modeling Communication Systems - Modeling and Analysis using Computational Tools

- Simulating Queuing Systems - Using MATLAB - Other Tools for Simulating and Analyzing.

MODULE V METHODS OF ESTIMATION 9

Tests of Hypotheses - Control of Traffic Intensity in M/G/1 and G/M/1 - Decision Problems in Queuing Theory - Performance Measures - Design Problems in Decision-Making - Control Problems in Decision-Making.

L –45 ; TOTAL HOURS –45

TEXTBOOKS AND REFERENCES:

1. Bhat, U. Narayan, An Introduction to queuing theory modeling and analysis in applications‖,2015, ISBN: 978-0-8176-8420-4.
2. Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris,Fundamentals of Queueing Theory‖, 2008,4th Edition, ISBN: 978-0-471-79127-0.
3. AttahiruSule Alfa,Queueing Theory for Telecommunications, Springer US, 2010, 978-1-4419-7313-9.

COURSE OUTCOMES :

After completion of the course, students should be able to

CO1: Elucidate basic concepts in descriptive statistics and probability theory.

CO2: Resolve standard problems that include Queuing systems.

CO3: Delineate basic concepts in the theory of Markov processes, M/M/m, M/M/m/K and M/M/m/K/C queuing systems.

CO4: Develop and relate formulas for properties of M/M/m, M/M/m/K and M/M/m/K/C queuing systems and solve problems using computer aid Matlab or Mathematica.

CO5: Measure the traffic intensity, blocked traffic and the operation of queuing systems

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H		M		M	L	L					L	M	M
CO2	L	M	L		M	L	L			M	L		M	M
CO3	M	H	M	H	L	L	L			M			H	M
CO4	L	H	M	M	M	L	M			M			H	M
CO5	H	M	H	H	M	M	L			M			M	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: : By learning “Queuing Theory” the students will be able to analyze methods to extract data sets from the Queuing Theory with guidelines and frameworks for various real time applications which leads to sustainable economic growth and provide productive employment.

CSDX 102	DISTRIBUTED COMPUTING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the architecture of distributed computing and virtualization.
COB2: To get familiar with various types of communication in distributed systems.
COB3: To gain knowledge on naming and coordination schemes in distributed environment.
COB4: To impart basics of various distributed consistency and replication models.
COB5: To acquire understanding of fault tolerance and security mechanisms in distributed computing environment.

MODULE I DISTRIBUTED COMPUTING ARCHITECTURE 9

Design goals-Types of distributed system-Architecture styles-Middleware organization-System architecture -Threads-Virtualization.

MODULE II COMMUNICATIONS 9

Layered protocols-Types of communication-Remote procedure call-Message oriented communication-Multicast communication.

MODULE III NAMING AND CO-ORDINATION 9

Flat Naming-Structured Naming-Attribute-based Naming-Clock Synchronization Logical Clocks-Mutual Exclusion-Election Algorithms-Distributed event matching Gossip based coordination.

MODULE IV CONSISTENCY AND REPLICATION 9

Introduction-Data-Centric consistency models- Client-Centric consistency models-Replica Management-Consistency protocols-Caching and replication in web.

MODULE V FAULT TOLERANCE AND SECURITY 9

Failure Models-Process Resilience-Reliable Client-server Communication-Reliable Group Communication-Distributed Commit-Recovery-Security threats Cryptography-Secure Channel-Access control-Secure Naming-Security Management.

L – 45; TOTAL HOURS –45

TEXT BOOKS AND REFERENCES:

1. Andrew S Tanenbaum, Maartenvan Steen, "Distributed Systems – Principles and Paradigms", 2nd Edition, Pearson Education, ISBN=1543057381, 2017.
2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, ISBN=8120313801,2008.
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, ISBN=0321263545,2009.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Elucidate the organization of distributed systems and virtualization.
CO2: Describe various communication techniques employed in distributed computing environment.
CO3: Demonstrate the working of naming and coordination schemes in distributed computing systems.
CO4: Illustrate the functionalities of consistency and replication techniques.
CO5: Apply suitable fault tolerance and security mechanism in distributed application development.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M		L				L							L
CO2	L				L					L		H		
CO3	L	M					H		M					M
CO4				L	H							L		L
CO5	M	L								M				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Promote inclusive and sustainable industrialization, enhance research and upgrade the technology. Streamlines a system by removing human inputs, which decreases errors, increases speed of delivery, boosts quality, minimizes costs, and simplifies the business process.

CSDX 103	CYBER LAWS AND ETHICS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamentals of cyber security and the importance of securing information and systems..

COB2: To explore the awareness about the various amendments and laws in IT.

COB3: To expose the theoretical and practical aspects of cyber law

COB4: To gain knowledge on Cyber security regulation and policy.

COB5: To learn the importance of ethical values in digital age.

MODULE I CYBER SECURITY 9

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

MODULE II INFORMATION TECHNOLOGY ACT 9

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

MODULE III CYBER LAW AND RELATED LEGISLATION 9

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

MODULE IV CYBERSPACE AND THE LAW & CYBER FORENSICS **9**

Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics.

MODULE V CYBER ETHICS **9**

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to BLOCKCHAIN Ethics.

L – 45; TOTAL HOURS –45

REFERENCES:

1. Mark Grabowski, Eric P. Robinson, Cyber Law and Ethics: Regulation of the Connected,Taylor& Francis Publications, 1st Edition, July 2021.
2. Sushma Arora and Raman Arora, Cyber Crimes & Laws, Taxmann Publications, 4th Edition, 2021.
3. Richard A. Spinello, Cyber Ethics-Morality and Law in cyberspaceǁ, Jones and Bartlett Learning, 7th Edition, Jones and Bartlett Publishers, 2020.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Explain the concepts and assess various harmful acts in cyber space.

CO2: Develop skills of using IT ACT for solving practical problems.

CO3: Demonstrate a thorough understanding of cyber law and their scope and limitations.

CO4: Analyze the significance of cyber security policy and regulation.

CO5 Identify the importance of ethics in addressing the challenges.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		H			M			L					H	
CO2	H				M	M								L
CO3		H		M				L		M				M
CO4		H							M					
CO5			H							M	M	M	L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The holistic understanding of using IT ACT for solving practical problems. Also identify and analyze the appropriate laws and ethics required to secure computers.

CSDX 104 SDG: 9	VIRTUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

COB1: To comprehend the fundamentals of virtualization and the significance of it.

COB2: To gain knowledge about the fundamentals needed to create virtual machines.

COB3: To examine concern virtual machine instances leveraging platforms.

COB4: To learn about optimal utilization of CPU and Memory for virtual machine.

COB5: To expose the students to create and manage storage and network resources in a virtual machine.

MODULE I OVERVIEW OF VIRTUALIZATION 9

Describing Virtualization - Moore's Law - Importance of Virtualization – Types - Current Trends - Virtualization and Cloud Computing - Virtualization Software Operation - Virtualizing Servers - Virtualizing Desktops - Virtualizing Applications - Hypervisor - Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor - Resource Allocation - Current Hypervisors - VMware ESX - Microsoft Hyper V

MODULE II INTRODUCTION TO VIRTUAL MACHINES 9

Virtual Machine - Examining CPUs in a Virtual Machine - Examining Memory in a Virtual Machine - Examining Network Resources in a Virtual Machine - Examining Storage in a Virtual Machine - Working with Virtual Machines - Virtual Machine Clones - Templates - Snapshots - Containers.

MODULE III VIRTUAL MACHINE CREATION 9

Performing P2V Conversions - Investigating the Physical-to-Virtual Process - Hot and Cold Cloning - Loading the Environment - VMware Workstation Player - Loading Virtual Box - Building a new Virtual Machine.

MODULE IV MANAGING CPU AND MEMORY FOR VIRTUAL MACHINE 9

CPU Virtualization - Configuring VM CPU Options - Tuning Practices for VM CPUs - Choosing Multiple CPUs - Hyper-Threading - Memory Virtualization - Configuring VM Memory Options - Tuning Practices for VM Memory - Calculating Memory Overhead - Memory Optimizations.

MODULE V MANAGING STORAGE AND NETWORKING FOR A VIRTUAL MACHINE **9**

Storage Virtualization – Configuring VM Storage Options - Tuning Practices for VM Storage - Network Virtualization - Configuring VM Network Options - Tuning Practices for Virtual Networks - Deploying Applications in a Virtual Environment- Designing Virtual Networks for Security- Securing Hypervisor.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Matthew Portnoy, “Virtualization Essentials”, Wiley, Second edition, ISBN : 9788126564668, 2016

REFERENCES:

1. Daniel Kusnetzky, "Virtualization: A Manager's Guide", O'Reilly Media, Illustrated, 9781449306458 2012.
2. Tom White, “Hadoop: The Definitive Guide Storage and Analysis at Internet Scale” O'Reilly Media Press, ISBN: 9781449311520, 2012.
3. Dave Shackleford, “Virtualization security- Protecting Virtualized Environments”, Sybex Publishers, First Edition, ISBN : 978118288122, 2012.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the virtualization concepts and their role in elastic computing.

CO2: Articulate the main concepts, architecture, taxonomy, key technologies, strengths, and limitations of Virtualization.

CO3: Analyze different types of virtualizations with performance metrics.

CO4: Analyze the constraints and techniques in setting up virtualization through its enabling technologies.

CO5: Design virtualization infrastructure solutions and give recommendations based on the need.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		H			M			L					H	
CO2	H				M	M								L
CO3		H		M				L		M				M
CO4		H							M					
CO5			H							M	M	M	L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The holistic understanding of building virtual machines and environment leads to construction of virtualized infrastructure and sustainable industrialization.

CSDX 105	XML AND WEBSERVICES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore the XML fundamentals and Document Type Definitions.

COB2: To impart knowledge on the web services using different types of protocols.

COB3: To learn the web development application tools and E-Commerce business strategy.

COB4: To acquire knowledge on the trade-offs and issues that are involved in designing a web service.

COB5: To become familiar with XML security and its structure.

MODULE I XML FUNDAMENDALS 9

XML Fundamentals: XML Documents - XML Namespaces - Explicit and Default Namespaces, Inheriting Namespaces - XML Schema - Implementing XML Schema Types, Elements, Inheritance, Substitution Groups, Global and Local Type Declarations, Managing Schemas, Schemas and Instance Documents, XML Schema best practices. Modern data formats JSON anDXML.

MODULE II WEB SERVICES 9

Introduction: Web Services - SOAP – SOAP Message Format – SOAP Communication Style – WSDL – WSDL Building Blocks – Containment structure of a WSDL document – Logical relationships between WSDL elements - UDDI - UDDI Business registry- Accessing UDDI – UDDI API – Private versus Public UDDI registries. Blogs: Features, Services, Creating a new blogs, Uploading the data, Retrieve the data.

MODULE III BUILDING WEB SERVICES AND E-COMMERCE 9

Developing web services in Java – Preparing sample applications – Building web services clients – Programmatic access to WSDL – UDDI access from Java and web browsers.B2B, B2C applications, Different types of B2B interaction, Components of E-Business XML systems, Java APIs for XML services.

MODULE IV XML AND CONTENT MANAGEMENT 9

Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – Content management workflow – XLANG – WSFL

MODULE V MODULE NAME 9

Security Overview - Canonicalization - XML Security Framework - XML Encryption - XML Digital Signature - XKMS Structure - XML In Practice.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, —Building Web Services with Microsoft Azure‖, Packet publishing, 1st Edition, ISBN: 9781784398, 2015.
2. Ron Schmelzer et al, —XML and Web Services Unleashed‖, Pearson Education, 2014.

REFERENCES:

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, —Web Services: Concepts, Architectures and Applications‖, Springer, Illustrated Edition, ISBN:3662108763, 2013.
2. Frank P.Coyle, —XML, Web Services and the Data Revolution‖, Pearson Education, 2010.
3. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,— Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World‖, Springer, 2nd Edition, ISBN:9783642624681, 2012.
4. Russ Basiura and Mike Batongbacal, —Professional ASP .NET Web Services‖, Apress, 2009.
5. Ron Schmelzer et al, —XML and Web Services Unleashed‖, Pearson Education, 2011.
6. Glenn Hostetler, Sandor Hasznos and Christine Heron, Web Service and SOA Technologies, Practicing Safe Techs", 1st Edition, 2009.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Prepare XML documents using Document Type Definitions and schemas according to industry standards.

CO2: Create web based application with the suitable markup languages.

CO3: Develop web services for E-commerce applications.

CO4: Illustrate the need for content management in web services.

CO5: Identify the security mechanisms for XML applications.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M				L								M	
CO2			L		M									
CO3	L			M					L				M	
CO4			L								M		L	
CO5	L				H	L								

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Implementing XML and Web services in small and medium-sized enterprises can improve production, improve processes and marketing strategies

CSDX 106	OPEN-SOURCE TECHNOLOGIES	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the content and operation of free open source software.

COB2: To understand the principles of GNU/Linux and distributions.

COB3: To acquire programming skills in Python.

COB4: To provide knowledge on PostgreSQL

COB5: To explore the programming languages like PHP and Perl.

MODULE I INTRODUCTION 9

The concept of software freedom – Modifications – consequences of the freedom of software – Free software before free software – The beginning - BSD,GNU –Free software licenses – Free software and public administrations.

MODULE II GNU LINUX 9

GNU/Linux – Introduction – Installation and File System hierarchy - General Overview – Kernel Mode and User Mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux .

MODULE III PROGRAMMINGLANGUAGUE- PYTHON 9

Introduction to Python – Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

MODULE IV DATABASE - POSTGRESQL 9

Key Features of PostgreSQL - Environment Setup - Syntax - Data Types - Working with Databases - Basic operators , Expressions , Queries - Case Study.

MODULE V PHP AND PERL 9

Introduction to PHP – Programming in Web Environment – Variables – Constants – Data Type – Operators – Statements – Functions – Arrays OOP – String Manipulation and Regular Expression-Perl Backgrounder – Perl Overview – Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines, Packages and Modules.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Richard Petersen, “Linux: The Complete Reference”,, Sixth Edition 6thEdition,ISBN-13: 978-0071492478,ISBN-10: 007149247X,2016.
2. Sandeep Koranne, “Handbook of Open Source Tools”, Springer, ISBN-13: 978-1441977182, ISBN-10: 144197718X, 2011.

REFERENCES:

1. KY Cheung, “Scientific Database and Programming Examples Using PHP, MySQL, XML, MATLAB, Python, Perl Hardcover”, Xlibris Corporation, Import, 27 Sep 2011

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the open source software and its license.

CO2: Illustrate the advanced concepts in linux environment.

CO3: Implement basic python programs.

CO4: Write the database applications using PostgreSQL.

CO5: Develop web applications using PHP and Perl.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H	M	M	M	L	L							M	
CO 2				H	M								L	
CO 3		H		M	M			M						H
CO 4		M	M	M	M								M	
CO 5		L	M	M	M					H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The holistic understanding of GNU models and enabling open source tools for business analytics, data science artificial intelligence leads to construction of an expert systems.

CSDX 107	IMAGE PROCESSING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the fundamentals of image pre-processing.

COB2: To understand various approaches on image formation and Feature extraction.

COB3: To attain knowledge on types of image segmentation and modelling.

COB4: To conceptualize methods for object measurement and processing of binary images.

COB5: To develop image processing techniques for correcting and enhancing images.

MODULE I FOUNDATION 9

Components of Image processing system – Image Representation – Neighborhood operations – Multi scale Representation.

MODULE II IMAGE FORMATION AND FEATURE EXTRACTION 9

Quantitative Visualization – Image formation – Digitization, Sampling and Quantization-Averaging – Box filter – Binomial filter - Edges – General properties of Edge filters– Gradient Based Edge Detection - Simple Neighborhood – Motion – Texture.

MODULE III IMAGE SEGMENTATION AND MODELING 9

Segmentation – Pixel based, Edge based, Region based, Model based segmentations - Regularization and modeling – Unifying local analysis and global knowledge – Diffusion models – Network models – Inverse filtering.

MODULE IV IMAGE ANALYSIS 9

Processing binary images- Correlation, Classification, Identification and Matching- Tomography- Methods for object measurement.

MODULE V PROGRAMMING 9

Applications – Handling image files – Establishing image processing tools – Correcting and enhancing images - Programming with Open CV

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. John C Russ, “Image processing handbook”, CRC Press, 7th Edition, ISBN: 9781498740289, 2016. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 43rd edition, New Delhi, 2012.

REFERENCES:

1. Gloria Bueno García, Learning Image Processing with OpenCVǁ, Packt Publishing, 1st Edition, ISBN: 9781783287666, 2015.
2. Bernd Jahne, “Digital image processing”, Springer Science and Business Media, 5th Edition, ISBN: 978366204781, 2013

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe image processing system and Image representation.

CO2: Identifies image formation and feature extraction using quantitative visualization and edge filters.

CO3: Analyze the various image segmentation techniques to enhance images.

CO4: Develop image analysis procedures to improve image quality.

CO5: Design image using OpenCV.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					L				M					H
CO 2									M				M	
CO 3		H						M						
CO 4			M						M				M	
CO 5										H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Study of image processing can help bring in innovation in Artistic effects, Bio-medical, Industrial Inspection, Geographic Information system, Law Enforcement.

CSDX 108	COMPUTER VISION	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the basic principles of 2D and 3D transformations of computer vision

COB2: To learn the image processing for global optimization and image restoration.

COB3: To study feature detection and matching for motion objects.

COB4: To acquire knowledge on motion estimates for motion structures.

COB5: To familiarize the approaches on face, instance and category recognition.

MODULE I INTRODUCTION 9

Image Formation – Geometric primitives – 2D Transformations – 3D Transformations – 3D Rotations – 3D to 2D projections - Photometric image formation - Digital camera.

MODULE II IMAGE PROCESSING 9

Point operators -Linear filtering - Neighborhood operators, Fourier transforms –Pyramids and wavelets – Geometric transformations – Global optimization – Image restoration – Segmentation.

MODULE III FEATURE DETECTION AND MATCHING 9

Points and patches –Edges – Lines - Feature-based Alignment – 2D, 3D feature-based alignment - Pose estimation - Image Stitching - Dense motion estimation - Optical flow - Layered motion - Parametric motion - Structure from Motion.

MODULE IV MOTION ESTIMATION 9

Structure from motion – Triangulation – Two-frame structure from motion – Factorization – Bundle adjustment – Constrained structure and motion – Transactional alignment – Parametric motion – Spline-based motion – Optical flow – Layered motion.

MODULE V RECOGNITION 9

Object detection, face recognition, instance recognition, category recognition, Stereo Correspondence – Epipolar geometry, correspondence, 3D reconstruction.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 2nd edition, 2022, (ISBN-13: 9783030343712).

REFERENCES:

2. David A. Forsyth and Jean Ponce, “Computer Vision: A Modern Approach”, Pearson, 2nd edition, February 2012, (ISBN-13: 978-0273764144).
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Academic Press, 3rd edition, 2012, ISBN-13: 978-0-123-96549-3).
4. Richard J Radke, “Computer Vision for Visual effects”, Cambridge University Press, 1st edition, 2013, (ISBN-13:9780521766876).

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Describe the fundamentals of image formation techniques required for computer vision.

CO2: Analyze Geometric transformations and Global optimization on images.

CO3: Identify the feature detection and matching on different motion objects.

CO4: Predict motion estimates on motion structures.

CO5: Illustrate visual processing on object detection and face recognition.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	L	L							L	L	L	L	L	
CO 2	L	M	L	L	L				L	L	L		M	L
CO 3	L	H	M	L	L				M	L	L		L	L
CO 4	L	L	M	M					M	L	L		L	
CO 5	M	H	H	M	H				M	L	L	L	M	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The holistic understanding of the basic principles and techniques of image processing enable the computing devices to process, analyze and interpret visual data in the most prominent industries including agriculture, healthcare, transportation, manufacturing and retail.

CSDX 109	SOFTWARE METRICS AND TESTING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To recognize the fundamental concepts of quality management.

COB2: To understand the knowledge on quality tools in software metrics.

COB3: To acquire the types of metrics in model development.

COB4: To learn strategies and guidelines of software testing.

COB5: To expose the testing design methods on software testing.

MODULE I SOFTWARE QUALITY ASSURANCE 9

Quality: Popular Views, Quality Professional Views, Software Quality, Total Quality Management - Fundamentals of Measurement Theory -Software Quality Metrics Overview

MODULE II SOFTWARE QUALITY METRICS 9

Applying The Seven Basic Quality Tools In Software Development: Ishikawa's Seven Basic Tools - The Rayleigh Model: Reliability Models, the Rayleigh Model Basic Assumptions, Implementation, Reliability and Predictive Validity.

MODULE III COMPLEXITY METRICS AND MODELS 9

Lines of Code, Halstead's Software Science, Cyclomatic Complexity Syntactic Metrics, An Example of Module Design Metrics in Practice .Metric And Lessons Learned for Object Oriented Projects: Object Oriented Concepts And Constructs, Design And Complexity Metrics, Productivity Metrics, Quality And Quality Management Metrics, Lessons Learned For object oriented Projects.

MODULE IV SOFTWARE TESTING 9

System Testing: Threads, Basic concepts for requirements specification, finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF. Interaction Testing: Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing. Object-Oriented Testing. Class Testing.

MODULE V SOFTWARE TESTING METHODOLOGIES 9

Decision Table-Based Testing, Data Flow Testing, Levels of Testing: Traditional view of testing levels, Alternative lifecycle models, The SATM system, Separating integration and system testing, Integration Testing.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Stephen H Khan," Metrics and Models in Software Quality Engineering", Pearson 2nd edition 2013.ISBN: 978-81-203-1136-7
2. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2013.ISBN: 9670201785602

REFERENCES:

1. S.A.Kelkar,‖Software quality and Testing‖, PHI Learing, Pvt, Ltd.,1st Edition,ISBN: 9788120346284, 2012.
2. Norman E-Fentor and Share Lawrence Pflieger,—Software Metrics, International Thomson Computer Press,2nd Edition,ISBN: 9781850322757, 1997.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Outline the software quality assurance and fundamentals of software quality metrics

CO2: Measure the software quality based on measurement theory using quality tools.

CO3: Compare and pick out the right reliability model for evaluating the software

CO4: Comprehend the types of software testing plans.

CO5: Apply the various software testing strategies in industrial practices.

Board of Studies (BoS) :	**Academic Council:**
22nd BoS of CSE held on 17.08.2023	21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H				L							M		
CO2	L		M	L								M		
CO3	L	H						M						
CO4	L	M		L									M	
CO5	H									H			M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: By learning the concepts of software metrics and testing, the students are able to analyze and develop software product with the use of the software testing process.

CSDX 110	SOFTWARE REQUIREMENTS AND MODELLING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamentals on requirement engineering lifecycle process.

COB2: To gain knowledge on requirements elicitation techniques and preparing requirements analysis documents.

COB3: To explore the awareness how requirements negotiation and validation to improve software quality.

COB4: To expose software requirements management activities used in an agile development environment.

COB5: To highlight the different tools for requirements management and cost estimation factors.

MODULE I SOFTWARE REQUIREMNTS 9

Introduction – Requirements, System Engineering – Lifecycle – Traceability – Modelling – Testing – Process of Requirements Engineering – Developing Systems – Generic Process Context – Process Introduction – Process Information Model – Process Details.

MODULE II SYSTEM MODELLING 9

Representation of Requirements Engineering – Methods – Writing and Reviewing Requirements – Eliciting Requirements – Requirement Sources –Kano Model – Elicitation Techniques – Documenting Requirements – Quality Criteria for Requirement Documents.

MODULE III REQUIREMENT VALIDATION 9

Requirements Validation –Quality Aspects of Requirements – Principles of Requirements Validation – Validation Techniques – Requirements Negotiation -Reusability.

MODULE IV REQUIREMENT MANAGEMENT 9

Prioritizing Requirements – Traceability of Requirements – Versioning – Management of Requirement Changes – Change Control – Measurement of Requirements – Requirements Engineering for Agile Methods – Web-Based Information Systems.

MODULE V REQUIREMENTS ESTIMATION 9

Size Estimation – Function Points – COCOMO - LOC Estimation - Effort, Schedule and Cost Estimation – Estimation Factors – Requirements Feature Cost Justification – Requirements Management Tools.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Elizabeth Hull, Ken Jackson, Jeremy Dick," Requirements Engineering", 3rd Edition, Springer, ISBN:9781447137306 2013.
2. Klaus Pohl, Chris Rupp. " Requirements Engineering Fundamentals", 2nd Edition, Rocky Nook, ISBN:9781937538842, 2015.

REFERENCES:

1. Swapna Kishore & Rajesh Naik, "Software Requirements and Estimation", Tata McGrawHill, ISBN-978-007-040312-3,2008.
2. Ian Sommerville and P Sawyer, "Requirements Engineering a Good Practice Guide", 1st Edition, Wiley India, ISBN: 978-0-471-97444-4,1997.
3. Leffingwell, D.Widrig, D, "Managing Software Requirements A Use Case Approach", 2nd Edition, Pearson Education, ISBN: 9780201615937, 2000.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Explore requirement analysis methods and traceability of requirements

CO2: Analyze the various requirements elicitation methods and identify the requirements of a project and document requirements.

CO3: Reuse the requirements for effective utilization of time and cost.

CO4: Apply methods and tools for requirements management from the development of project

CO5: Use appropriate cost estimation methods when preparing the requirements specification document.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M	L	H	M		M	M	L	M	M	H		H	
CO 2	H	H	L	M	L			L		L	M			H
CO 3		M	M		H			L		M	M		H	M
CO 4		L		L	H		L						H	M
CO 5			M		H			L		L			M	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The learner is able to evaluate various forms of industrialization and compare their resilience

CSDX 111	FOUNDATION ON ROBOTICS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To familiarize the basic concepts of robotics.

COB2: To understand the basic knowledge on industrial robotics and classification.

COB3: To study the functionalities of sensors and machine vision.

COB4: To examine the operational capabilities and specifications.

COB5: To explore the robot programming methods and its applications.

MODULE I FUNDAMENTALS OF ROBOTICS 9

Robot - Definition - Robot Anatomy - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll,
Joint Notations, Speed of Motion, Pay Load- Robot Parts and Functions-Need for Robots-Different Applications.

MODULE II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C.ServoMotors, Stepper Motors, Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers.

MODULE III SENSORS AND MACHINE VISION 9

Internal and external sensors, characteristics, types of actuators, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

MODULE IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 9

Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and Simple Programs.

MODULE V IMPLEMENTATION AND ROBOT ECONOMICS 9

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Eteokleous, Nikleia, Nisiforou," Deigning, constructing and programming Robots for learning",IGI Global Publication,2021

REFERENCES:

1. Tsuneo Yoshikawa, Robotics, IT Publication, 1st Edition, 2021
   Ashutosh Kumar Dubey, Abhishek Kumar, S.Rakesh Kumar," AI and IOT Based Intelligent Automation in Robotics", Wiley Publication, 2021.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Design the code for control, programming and development of robotic system.

CO2: Demonstrate the knowledge of industrial robots, end effectors and gripper.

CO3: Acquire knowledge on sensor and machine vision.

CO4: Analyze the working principle of kinematics and Robot Programming.

CO5: Develop the applications of robots in industries.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M	M	M	L	L	L			L	L	L		L	
CO 2	M	M		L	L	L			L	L	L		L	L
CO 3	M	M	M	L	L				L	L			L	
CO 4	M	M	M		H	L			M	L	L		L	
CO 5	M	L	L	M	L				M	L	L		L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Learn the fundamentals of robotic system design, control, programming, and growth also analyze the foundation for governance and security around the implementation of robotics.

CSDX 112	**STATISTICS AND ANALYTICS USING R PROGRAMMING**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To learn basic of R programming.

COB2: To understand the sample data representation using charts, graphs and plots.

COB3: To explore the research problem and set the objectives.

COB4: To expose the statistical inference methods.

COB5: To know the regression models and evaluate the findings.

MODULE I BASIC CONCEPTS 9

Introduction to R - Variables and the Case Format - Central Tendency and Variability - Descriptive Statistics - Data acquisition and inspection - PDFs and CDFs - Normal Model.

MODULE II VISUALIZATION 9

Bar Charts – Histograms - Segmented Bar Charts - Box Plots - Comparative Box Plots - Pie and Waffle Charts - Pareto Charts - QQ Plots - Tests for Normality – Scatterplots - Contingency Tables.

MODULE III FOUNDATIONS FOR RESEARCH 9

Randomness and Sampling Strategies - Experiments vs. Observational Studies - R's 12 Steps - Developing Research Questions - Power Analysis - Sampling Distributions - Central Limit Theorem - P-Values - Confidence Intervals - Controversy.

MODULE IV STATISTICAL INFERENCE 9

Confidence Intervals And Standard Error–Means - One Sample t-test - Two Sample t-test - Two Sample t-test - Paired t-test - One Proportion z-test - Binomial Test - Two Proportion z-test - Chi-square Test Independence, One Variance, F Test – One way Analysis of Variance (ANOVA).

MODULE V REGRESSION AND INFERENCES ON REGRESSION 9

Simple Linear Regression - Multiple Regression - Hypothesis Tests of Regression Coefficients - Real time case study.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Nicole M. Radziwill, “Statistics (The Easier Way) with R: an Informal Text on Applied Statistics”, Lapis Lucera Publishers, ISBN-13: 978-0692339428, 2015.

REFERENCES:

1. John M. Quick, “Statistical Analysis with R – Beginner’s Guide”, Packt Publishing, ISBN: 9781849512084, 2010.
2. Richard Cotton, “Learning R”, O'Reilly Publications, First edition, ISBN-13: 978-9351102861, 2013.

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Acquire the basics of R programming and apply it for statistical problem solving

CO2: Express the given sample sets using visual tools like charts, graphs and plots.

CO3: Formulate the research problem and provide solutions.

CO4: Apply Statistical inferences and propose actions based on the findings.

CO5: Analyse a given real time scenario, apply regression and interpret the results.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H		M		M	L	L					L	M	M
CO 2	L	M	L		M	L	L			M	L		M	M
CO 3	M	H	M	H	L	L	L			M			H	M
CO 4	L	H	M	M	M	L	M			M			H	M
CO 5	H	M	H	H	M	M	L			M			M	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Learn the fundamentals of R programming and use it to solve real time problems using statistical methods. Implement statistical inferences and suggest actions in light of the results.

CSDX 113	ESSENTIALS OF DATA SCIENCE	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand statistical inference in the process of conducting analysis of real-world datasets.

COB2: To expose the fundamental concepts and techniques in data science.

COB3: To learn the application of probability in data science.

COB4: To gain knowledge on predictions using regression and classification methods.

COB5: To explore critically about data and bring in robust conclusions.

MODULE I INTRODUCTION 9

Data Science – Introduction - Computational Tools - Statistical Techniques - Need for Data Science –Data Science Life Cycle–Roles – Data Scientists – Data Analysts – Data Engineer – Data Science Tools.

MODULE II PROBABILITY AND DISTRIBUTIONS 9

Finding Probabilities - Sampling - Empirical Distributions - Testing Hypotheses - Assessing Models - Multiple Categories - Decisions and Uncertainty - Error Probabilities - Comparing Two Samples - A/B Testing – Deflategate - Causality - Estimation –Mean –Variability – Standard Deviation - Normal Curve - The Central Limit Theorem - Choosing Sample Size.

MODULE III REGRESSION 9

Prediction - Correlation - The Regression Line - The Method of Least Squares - Least Squares Regression - Visual Diagnostics -Numerical Diagnostics - Inference for Regression - A Regression Model - Inference for the True Slope - Prediction Intervals - Multiple Regression.

MODULE IV CLASSIFICATION 9

Classification - Nearest Neighbours - Training and Testing - Rows of Tables - Implementing the Classifier – Performance Measures - Updating Predictions - Binary Classifier - Making Decisions.

MODULE V VISUALIZATION 9

Visualization – Scatter Plots – Line Plots - Categorical Distributions – Numerical Distributions – Applications – Case Study.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Ani Adhikari and John DeNero, “Computational and Inferential Thinking: The Foundations of Data Science”, 2019.

REFERENCES:

1. The Art of Data Science: A Guide for Anyone Who Works with Data, Roger D. Peng, and Elizabeth Matsui, ISBN: 9781365061462, 2018.
2. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios. by Steve Wexler, Jeffrey Shaffer, Andy Cotgreave, ISBN: 1119282713,2017

COURSE OUTCOMES:

After completion of the course, Students should be able to

CO1: Apply statistical techniques for data analysis

CO2: Describe the role of Sampling and Distributions in data analysis

CO3: Implement regression algorithms for numerical data.

CO4: Measure the performance using classification algorithms for categorical data

CO5: Demonstrate data visualization and discuss how data can be used responsibly to benefit society.

Board of Studies (BoS) :
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Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H	M	L		L								H	
CO 2	H	M	L	L	L	L							H	
CO 3	H	L	L	M	H	L						L		M
CO 4	H	L	L	M	L							L		L
CO 5	M	M	M	H	M	M						M		H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: By learning the concepts of Essentials of Data Sciences, the students are able to apply the probability and statistics into data science and able to discover hidden patterns which in turn improve the economic growth.

SEMESTER VI

CSDX 221	**ROUTING PROTOCOLS**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To impart knowledge about network routing concepts.

COB2: To learn the working of basic routing protocols such as distance vector and link state routing.

COB3: To discuss the importance of Quality of Service (QoS) and traffic engineering in routing.

COB4: To study the operations of internet routing algorithms.

COB5: To highlight the design issues in various wireless Ad Hoc routing networks.

MODULEI NETWORK ROUTING CONCEPTS 9

Introduction to Networks – Network Architecture and Standards – Glimpse at the Network Layer – Addressing in TCP/IP Networks – Overview of Routing –RoutingTaxonomy – Host Mobility and Routing - Introduction to basic Routing Algorithms - Routing Strategies – Non Adaptive Algorithms-Adaptive Algorithms – Flooding – Static Shortest Path Routing Algorithms –Dynamic Shortest Path Routing Algorithms.

MODULEII BASICROUTINGPROTOCOLS 9

Routing Protocols – Distance Vector Routing – Working of the Protocol -Convergence of Distance Vector Table - Issues in Distance Vector Routing -Improvements in Distance Vector Routing - Advantages and Disadvantages - Link State Routing - Working of the Protocol -Routing Tables - Path Vector Routing -Working of the Protocol - Unicast, Multicast, and BroadcastRouting.

MODULEIII QUALITY OF SERVICE ROUTING AND TRAFFIC ENGINEERING 9

Introduction - QoS Measures - Differentiated and Integrated Services –QoS Routing Algorithms – QoS Unicast Routing Protocols – QoS Multicast Routing Protocols -QoS Best Effort Routing - Routing and MPLS Traffic Engineering-MPLS Fundamentals – Traffic Engineering Routing Algorithms- Minimum Interference Routing Algorithm -Profile Based Routing Algorithm – Dynamic Online Routing Algorithm.

MODULE IV INTERNET ROUTING 9

Interior Gateway Protocols -Distance Vector Protocols - RoutingInformation Protocol -Interior Gateway Routing Protocol -Link StateProtocols -Open Shortest Path First Protocol -Intermediate Systemto Intermediate System Protocol - Exterior Gateway Protocol - Hostsvs Gateways - Gateway to Gateway Protocol -Autonomous System -CharacteristicsofEGP-EvolutionofEGPStandards-EGPTerminology and Topology -EGP Operation Model - Border GatewayProtocol.

MODULE V ROUTING IN WIRELESS AD HOC NETWORKS 9

Basics of Wireless Adhoc networks – Issues with existing protocols - Routing in Wireless Ad Hoc Networks - Table Driven (Proactive), OnDemand(Reactive),Hybrid,Hierarchical,Geographic,PowerAware RoutingProtocols.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Sudip Misra, Sumit Goswami, “Network Routing: Fundamentals, Applications, and EmergingTechnologies”, Wiley publication, ISBN: 978-0-470-75006-3,2017.
2. Deepankar Medhi, Kartikeyan Ramasam , "Network Routing - Algorithms, Protocols, Architecture”, 2nd Edition, Morgan Kauffman Series Publication, ISBN:9780128008294, 2017.

REFERENCES:

. Mounir Frikha ,“Ad Hoc Networks:Routing, QoS and Optimization”, Wiley-ISTE, ISBN: 978-1-84821-227-5, 2011.
. Subir Kumar Sarkar,T.G.Basavaraju and C.Puttamadappa, "AdHoc Mobile Wireless Networks - Principles, Protocols and Applications", 2nd Edition, Auerbach publications, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Apply IP addressing concepts and select suitable routing algorithms for real time scenarios.

CO2: Analyze the working of distance vector routing and link state routing protocol.

CO3: Inspect the QoS and traffic engineering parameters in different routing algorithms.

CO4: Compare the characteristics and working of Internet routing protocols.

CO5: Relate the issues in existing routing protocols and explore the various mobile routing protocols.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H												H	
CO 2		H											M	
CO 3			M	H			M						H	
CO 4	L				H	L							L	
CO 5		L	M	H			M					L	M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: This course provides a comprehensive knowledge about the different network routing algorithms and protocols. It provides a wide outline of the working of different routing protocols in modern day networks. It aids to enhance the research and innovations in the field of traffic engineering and Mobile Ad hoc networks.

CSDX 222	INTRUSION DETECTION AND PREVENTION	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To study the fundamental concepts in Intrusion detection.

COB2: To discuss the various Intrusion detection networks.

COB3: To understand the advanced detection methods.

COB4: To gain knowledge on the Intrusion prevention system.

COB5: To explore the intrusion detection techniques.

MODULE I INTRODUCTION 9

Intruder types – intrusion methods – processes and detection –message integrity and authentication - honeypots.

MODULE II INTRUSION DETECTION MODELS 9

General IDS model, data mining based IDS, Denning model, data mining framework for constructing features and models for intrusion detection systems.

MODULE III INTRUSION DETECTION AND PREVENTION SYSTEMS 9

Unsupervised anomaly detection, CV5 clustering, SVM, probabilistic and statistical modeling, general IDS model and taxonomy, evaluation of IDS, cost sensitive IDS - Lonere NBAD, specification based and rate based DDOS, scans/probes, predicting attacks, network based anomaly detection, stealthy surveillance detection; Defending against DOS attacks in scout: signature based solutions, snort rules.

MODULE IV DETECTION APPROACHES 9

Host – based anomaly detection, taxonomy of security flaws in software, self- modeling system calls for intrusion detection with dynamic window size.

MODULE V INTRUSION DETECTION NETWORKS 9

Secure intrusion detection systems , network security,secure intrusion detection environment, secure policy manager, secure IDS sensor, alarm management, intrusion detection system signatures, sensor configuration,signature and intrusion detection configuration,IP blocking configuration, intrusion detection system architecture

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Endorf,C.,Schultz E.and MellanderJ., “Intrusion Detection and Prevention”, McGraw-Hill.2003.

REFERENCES:

1. Gorbani A.A, Lu w Tavallaee M, “Network Intrusion Detection and Prevention-concepts and techniques”,Springer International Publishing,1st Edition, ISBN:9780387887708,2010.
2. Al-Sakib Khan Pathan, “The State of the Art in Intrusion Prevention and Detection”, CRC Press, Taylor and Francis Group, 1st Edition, ISBN:978-1-4822-0351-6,2014.
3. Umesh Hode ghatta Rao and Umesha Nayak, “The Infosec Handbook: An introduction to Information Security”, A Press,1st Edition, ISBN:978-1430263821, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify the needs of Intrusion detection networks.

CO2: Apply the architecture design of various Intrusion detection networks to solve real-time applications.

CO3: Adopt advanced detection Methods for solving research problems.

CO4: Compare the functioning of various detection approaches.

CO5: Develop the ability to choose the appropriate algorithm for designing intrusion detection networks.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M	L	M	L	L	L			M		M		M	L
CO 2	M	M	M	L	L	L			M		M		M	M
CO 3	M	H	M	L	L	M			M		M		M	M
CO 4	M	M	M	L	M	M			M		M		M	M
CO 5	M	M	M	L	M	M			M		M		L	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: This course provides a comprehensive knowledge to detect attacks that may elude from a network-based intrusion detection system / intrusion prevention system and can be used for future risk assessments.

CSDX 223	INTERNET OF THINGS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the characteristic, design challenges and security issues of IoT.

COB2: To comprehend the IoT architecture and data processing..

COB3: To expose requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.

COB4: To explore programming skill for an IoT applications in real-time scenario.

COB5: To study the design of simple IoT devices for different application domains.

MODULE I INTRODUCTION TOIOT 8

Definition & Characteristics of IoT – Challenges and Issues-Physical Design of IoT,Logical Design of IoT- IoT Functional Blocks – Overview of Governance, Privacy and Security Issues.

MODULE II IOT ARCHITECTURE 9

IoT reference architectures - Industrial Internet Reference Architecture – Edge Computing - IoT Gateways-Data Ingestion and Data Processing - Pipelines- Data Stream Processing.

MODULE III IOT PROTOCOLS 10

Industrial network protocols – Modbus – CANbus, Communicating with cloud applications - web services – REST -TCP/IP and UDP/IP sockets – MQTT-Web Sockets protocols. Message encoding- JSON - Protocol Buffers -Control Units Communication modules – Bluetooth – Zigbee – Wifi - GPS IOTProtocols-IPv6-6LoWPANM-RPL–CoAP-WiredCommunication- Power Sources.

MODULE IV IOT HARDWARE AND SOFTWARE 10

Arduino – setup – Arduino library – Embedded C programming - RaspberryPi – Architecture – Operating system – configuration – GPIO Connector –VNC Connection – interface sensor and actuators – Traffic light controller – LED blinking.

MODULE V IOT APPLICATIONS 8

Business models for the internet of things – Smart city-smart mobility and transport-smart buildings and infrastructure – smart health - environment Monitoring and surveillance.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. DonladNorris,“TheInternetofThings:Do-It-YourselfatHomeProjects for Arduino, Raspberry Pi and Beagle Bone Black”,McGraw-HillEducation- Europe,ISBN10 0071835202,2015.
2. OlivierHersent,DavidBoswarthick,OmarElloumi,“TheInternetof Things–KeyapplicationsandProtocols”,Wiley,2012.

REFERENCES:

1. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
2. Cuno Pfister, "Getting Started with the Internet of Things”,1st Edition, Shroff, O’REILLY, 2011, Harvard University.
3. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on- Approach)”,1st Edition, VPT, 2014.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Summarize the design concepts and security issues of IoT.

CO2: Describe the IoT architecture and data processing techniques.

CO3: Identify theIoT protocols and its standards for IoT based communication devices.

CO4: Interface IoT programming using Arduino and RaspberryPi for small IoT applications.

CO5: Apply the IoT concepts in real time applications using the IoT devices.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1						L							M	
CO 2			L				M						L	
CO 3	L												L	
CO 4	M			L	M									M
CO 5		M										L		L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Students will be able to address problems in the real world using a variety of IoT devices and networking in are as including business, health, environment,etc.

CSDX 224	SECURE INTERCONNECTING SYSTEMS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamentals and basic principles of Crypto network security protocols.

COB2: To learn the technologies and protocols applied to deliver fundamental security services in transport layer.

COB3: To familiarize with traffic and security analysis of TLS and DTLS protocols

COB4: To comprehend the security breaches in SSL/TLS protocols.

COB5: To explore the techniques to protect the systems from security intrusion related issues.

MODULE I SECURITYCONCEPTS 9

OSI security Architecture – Security Definition – Cryptography Systems – Classes – Secure Cryptosystems – History–Legal Situation – Cryptosystems – unkeyed – superkey – publickey.

MODULE II TRANSPORT LAYER SECURITY 9

Introduction – protocol evolution – SSL Protocol – Record protocols - Handshake protocol – Change cipher spec protocol – Alert protocol – Application Data Protocol–Traffic analysis of a SSLsession -Security analysis.

MODULE III TLSPROTOCOL 9

Introduction – TLS1.0 – TLS1.1 – TLS1.2 – Traffic analysis of a TLS session–Security analysis – DTLS Protocol – DTLS1.0 – DTLS1.2 – Securityanalysis

MODULE IV FIREWALLANDPUBLICKEYS 9

Firewall traversal – SSL/TLS tunneling – SSL/TLS Proxying – Public key Certificates – PGPcertificates–X.509 Certificates: Wildcard Certificates, International step up and SGC Certificates, Extended validation Certificates–Client Certificates.

MODULE V INTERNET SECURITY 9

System Intrusion detection and prevention – Computer forensics – Network forensics – Forensicstools – Scanning, filtering and blocking –Virus filtering – Content filtering.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Rolf Oppliger, "SSLandTLS:Theory and Practice",2nd edition, Artech House Pubslishers, ISBN- 978-1-59693-447-4,2016.
2. Joseph Migga Kizza, " Guide to Computer Network Security Computer Communications and Networks",5th edition,Springer,2020.

REFERENCES:

1. Eric Rescorla, "SSL and TLS: Designing and Building Secure Systems",Addison-Wesley;1st edition,2000
2. Stephen Thomas, "SSL andTLS Essentials:Securing theWeb", JohnWiley&Sons,ISBN-10:0471383546,2000.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the basic principles of cryptography relevant protocols.

CO2: Summarize the overall activities and working of SSL protocol.

CO3: Compare and contrast the concepts of TLS, SSL protocols and DTLS protocol.

CO4: Analyze how transport layer protocols securely traverse a firewall and demonstrate the importance of certificates.

CO5: Apply the security protocols for real time application scenarios.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H	L											H	
CO 2				M	M								M	
CO 3				H									L	
CO 4		H				M						M	H	
CO 5	M				H							L	H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: This course deals with the various benefits and needs of secureinterconnectedsystems.Thecoursehighlightsthesecurityissuesassociated with interconnections and ways to provide secure systems. By providing guidelines of secure networks and interconnections, this course paves way for innovations in the field of security.

CSDX 225	**FULL STACK MOBILEAPPLICATION DEVELOPMENT I(FRONTEND)**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB 1: To learn the basics of the web framework development.

COB 2: To provide the steps in JavaScript for building a webpage.

COB3: To acquire knowledge on JQuery for scripting and control functions in web pages.

COB 4: To explore Bootstrap and AngularJS in web design.

COB 5: To gain knowledge of ReactJS App framework.

MODULE I BASICS **9**

HTML – Basics – Common elements – Formatting HTML text – Headings - Style – Tables – Forms – Element grouping – Graphics – Media – APIs – Examples –CSS – Syntax – Colors – Backgrounds – Margins – Text – Font – List – Tables – Examples.

MODULE II JAVASCRIPT **9**

Javascript – Variables – Operators – Datatypes – Objects – Scope – Events –Functions – Control loops – Arrays – Forms – Forms API - DOM – Events –Strings - Numbers – Simple UI design – JSON.

MODULE III JQUERY **9**

Basics – DOM – CSS – Chaining – Jquery function – Filters – custom filters –selector filters – Functions –Traversal –Traversal up the DOM – CSS expressions – Forms – Manipulation - Creating, operating and adding HTML on the fly – HTML forms Events.

MODULE IV BOOTSTRAP AND ANGULARJS **9**

User Input - Forms – Tables – Images – Media - Bootstrap Javascript components – Advanced programming - Angular JS - Directives – Filters – Data binding – Views – Controllers – Scope – Modules – Creating a container in a Module – Routes – Role of Routes – Factories -Services.

MODULE V REACTJS **9**

Statefull Vs Stateless Components – Container react application – Solving a problem using React - React life cycle – Building complex React components –Using Flux in ReactJS – Case studies on using ReactJS.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Chong Lip Phang,, “Mastering Front-End Web Development: 14 Books in 1. Introducing 200+ Extensions”,. N.P., Amazon Digital Services LLC - KDP Print US, 2020, (ISBN-13: 9798567640135)
2. Kyrnin, Jennifer, and Meloni, Julie, “C.. HTML, CSS, and JavaScript All in One”, Pearson Education, 2018.(ISBN-13: 9780135167076).

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, India, 2012. (ISBN 13: 9788131704370)
2. Karavokyros, L.,Katsiotis, N., Tzanis, E., Batis, G., and Beazi-Katsioti, M., “The Effect of Mix-Design and Corrosion Inhibitors on the Durability of Concrete”, Journal of Materials Science and Chemical Engineering, Vol. 8, pp. 64-77, 2020. https://doi.org/10.4236/msce.2020.84005
3. Harvard University. Soft robotic gripper for jellyfish [Video], 2019. https://www.youtube.com/watch?v=guRoWTYfxMs

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Illustrate webpage design using HTML, CSS and JavaScript functions.

CO2: Implement basic JavaScript for webpage development.

CO3: Code JQuery for DOM traversal, event handling and animation.

CO4: Develop the Bootstrap framework using the forms.

CO5: Improve the views for the user and control the application workflow using ReactJS

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	L	M	M								L		H	M
CO 2	L	M	M								L		H	M
CO 3	L	M	M										H	M
CO 4	M	M	L								L		H	M
CO 5	L	L	M										H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Full stack developers must understand how to integrate front and back end systems by understanding the most commonly used software development and testing methodologies. New mobile app launches to drive action on Sustainable Development Goals.

CSDX 226	WEB ANALYTICS AND SOCIAL MEDIA MINING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To comprehend the web analytics tools and its behaviour.

COB2: To study the Facebook APIs and the extraction process.

COB3: To learn the clustering of LinkedIn contacts and Google+.

COB4: To explore mining strategies for web page content mining.

COB5: To learn the contents of GitHub and generate interest graphs.

MODULE I MINING TWITTER AND FACEBOOK 9

Twitter Terminologies, Twitter API connectivity, Exploring trending topics, Searching for tweets, Extraction and frequency analysis, Examining patterns, Visualization, Facebook social graph API, Open graph protocol, Analyzing facebook pages, Examining friendships.

MODULE II MINING LINKED IN AND GOOGLE+ 9

Making LinkedIn API Requests, Downloading LinkedIn Connections, User Experiences and clustering, Measuring Similarity, Clustering Algorithms, Exploring the Google+ API, Term Frequency and Inverse Document Frequency, Natural Language Tool kit, Finding Similar Documents, Analyzing Bigrams in HumanLanguage.

MODULE III MININGWEBPAGES 9

Scraping, Parsing,and Crawling the Web, Breadth – First Search in Web Crawling, Discovering Semantics by Decoding Syntax, Sentence Detection in Human Language Data, Document Summarization, Entity-Centric Analysis, Quality of Analytics for Processing Human Language Data.

MODULE IV MININGMAILBOXES 9

Unix Mailboxes, Getting the Enron Data, Converting a Mail Corpus to a Unix Mailbox, Converting Unix Mailboxes to JSON, JSONified Mail Corpus into MongoDB, Accessing MongoDB with Python, Analyzing the Enron Corpus, Discovering and VisualizingTime – Series Trends, Analyzing Your Own Mail Data.

MODULE V MININGGITHUB 9

Creating a GitHub API Connection, Making Git Hub API Requests, Modeling Data with Property Graphs, Seeding an InterestGraph, Computing Graph Centrality Measures, Extending the Interest Graphwith “Follows” Edges for

Users, Using Nodes as Pivots for More Efficient Queries, Visualizing Interest Graphs, Case Study.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS AND REFERENCES:

1. Matthew A Russell, “Mining the Social Web”, O′Reilly Publications, 2nd edition, ISBN-13: 978-1449367619, 2013.
2. Reza Zafarani, “Social Media Mining”, Cambridge University Press, ISBN-13: 978-1107512818, 2015.
3. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Sybex Publication, 3rd revised edition edition, ISBN-13: 978- 1118168448, March 2012.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Use appropriate web analytics tool for social media analysis.

CO2: Analyze Facebook and its contents and discover patterns.

CO3: Construct a clustering model to explore LinkedIn and Google+ connectivity patterns and user groups.

CO4: Formulate mining strategies to perform content mining on web pages.

CO5: Interpret the interest graphs generated by mining the contents of GITHUB

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M					H							H	
CO 2		L			M	M			L					L
CO 3					L	M		M						M
CO 4					L			L					M	
CO 5	L				M									L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

CSDX 227	CLOUDSECURITY	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basics of cloud computing and security.

COB2: To improve the cloud security issues and architectures.

COB3: To understand the data security and data storage in cloud.

COB4: To acquire knowledge on threats, risks, vulnerabilities in cloud.

COB5: To explore the structure of information security.

MODULE I INTRODUCTION TO CLOUD COMPUTING AND SECURITY **9**

Understanding Cloud Computing - The IT Foundation for Cloud –Cloud Computing Architecture - Cloud Reference Architecture - Control over Security in the Cloud Model - Cloud Deployment - Services Models – Cloud creation and Key examples – Real – world Cloud Usage Scenarios.

MODULE II SECURITY RISK ISSUES ANDARCHITECTURE **9**

Cloud Computing: Security Concerns – Assessing Your Risk Tolerance in Cloud Computing - Legal and Regulatory Issues - Security Requirements for the Architecture – Security Patterns and Architectural Elements-Cloud Security Architecture – Planning Key Strategies for Secure Operation.

MODULE III SECURING THE CLOUD:DATASECURITY **9**

Overview of Data Security in Cloud Computing - Data Encryption: Applications and Limits - Cloud Data Security: Sensitive Data Categorization - Cloud Data Storage – Cloud Lock – in –Securing the Cloud: Key Strategies and Best Practices- Overview of Security Controls-The Limits of Security Controls-SecurityMonitoring.

MODULE IV SECURITY CRITERIA: BUILDING AN INTERNAL CLOUD **9**

Private Clouds: Motivation and Overview - Security Criteria for Ensuring a Private Cloud- Security Criteria: Selecting an External Cloud Provider-Selecting a CSP: Overview of Assurance - Overview of Risks-Security Criteria.

MODULE V EVALUATING CLOUD SECURITY: AN INFORMATION SECURITY FRAMEWORK **9**

Evaluating Cloud Security - Checklists for Evaluating Cloud Security- Metrics for the Check lists - Operating a Cloud - From Architecture to Efficient and Secure Operations - Security Operations Activities

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Winkler, VicJR. “Securing the Cloud: Cloud computer Security techniques and tactics”, Netherlands, First edition, 2011.
2. Cope, Robert, et al. Cloud Computing Design Patterns. United Kingdom, Pearson Education, Netherlands, Second edition, 2015.

REFERENCES:

1. Mather, Tim, Subra Kumaraswamy, and Shahed Latif, “Cloud security and privacy: an enterprise perspective on risks and compliance”, O'Reilly Media, Inc.", California, First edition, 2009.
2. Krutz, Ronald L., and Russell Dean Vines, “Cloud security: A comprehensive guide to secure cloud computing”, Wiley Publishing, New Jersey, First edition, 2010.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Illustrate the basics of cloud computing architectures.

CO2:Describe cloud security architecture, challenges and requirements.

CO3: Explain the data security in cloud computing.

CO4: Identify the best practices and strategies for a secure cloud environment.

CO5: Demonstrate the efficient and secure operations in cloud computing.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1					L								L	L	
CO2								M	H				M	L	
CO3		H						M	M				M	L	
CO4	L												L	L	L
CO5										H			M	L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Able to apply and explore learning strategies for securing the private and public cloud.

CSDX 228	**ADVANCED COMPUTER GRAPHICS**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To introduce two dimensional and three dimensional objects..

COB2: To familiarize with various color models.

COB3: To gain knowledge in rendering techniques

COB4: To equip students with scene graph representation and transformation.

COB5: To learn kinematics in animation.

MODULE I 2D AND 3D CONCEPTS 9

Two-dimensional Geometric transformation - Two-dimensional viewing - Line, Polygon, Curve and Text clipping algorithms- Three-dimensional object representation-Polygons, Curved lines, Quadric Surfaces.

MODULE II COLOR MODELS 9

Color Models - RGB, YIQ, CMY, HSV - Animations - Conversation between HSV and RGB Models-HLS Color Model-Color Selection and Applications.

MODULE III RENDERING 9

Introduction to Shading models - Flat and Smooth shading - Adding texture to faces -Adding shadows of objects - Building a camera in a program - Creating shaded objects - Rendering texture - Drawing Shadows.

MODULE IV SCENE GRAPHS 8

Basic structure - Transformation hierarchy - Relative Transformations – Bounding Volume Hierarchy – Sample Implementation: Group node, Object Node, Camera Node.

MODULE V SKELETAL ANIMATION AND KINEMATICS 10

Articulated Character Models – Vertex Blending – Skeleton and Skin – Vertex Skinning - Robot Manipulators – Forward Kinematics – Linear and Angular Velocity – Inverse Kinematics

L – 45; TOTAL HOURS – 45

TEXT BOOKS AND REFERENCES:

1. Ramakrishnan Mukundhan “Advanced Methods in Computer Graphics with examples in in OpenGL”, Springer Education, ISBN: 9781447123392, 2012.
2. Donald Hearn, Pauline Baker, "Computer Graphics with OPENGL - C Version", Pearson Education, 4th Edition, 2010.
3. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics- Principles and practice", Pearson Education, 2nd Edition, ISBN: 0201848406, 2007.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Use two-dimensional and three-dimensional geometric transformation.

CO2: Develop own sense of aesthetics in designing visually appealing graphics.

CO3: Implement efficient rendering techniques.

CO4: Produce relative transformation using scene graphs.

CO5: Apply kinematics and deliver realistic animation.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1		L			H								H	
CO 2	L				M	L								L
CO 3		H			L									M
CO 4			H						M					M
CO 5	L					L			M				M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Advanced Computer Graphics would be useful to enhance manufacturing capacity, hence increasing the outcomes of medium to high-tech enterprises.

CSDX 229	HUMAN COMPUTER INTERACTION	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the guidelines for effective interface designs.

COB2: To explore the role of HCI in shaping user experiences and human behaviour.

COB3: To familiarize with the design process with the help of software tools.

COB4: To gain knowledge in techniques for creating seamless navigation experiences in digital interfaces.

COB5: To provide insights into advancing the user experience by focusing on usability, accessibility, and inclusive design.

MODULE I INTRODUCTION 9

Usability of Interactive Systems - Universal Usability - Guidelines, Principles, and Theories.

MODULE II DESIGN 9

Design - Evaluation and the User Experience – 8 golden rules of Interface design - Design case studies - Introducing Emotional Interfaces to Healthcare Systems.

MODULE III DESIGN PROCESS 9

Managing Design processes – Evaluating Interface Designs – Software Tools.

MODULE IV INTERACTION STYLES 9

Direct Manipulation and Immersive Environments - Fluid Navigation - Expressive Human and Command Languages – Devices - Communication and Collaboration – Voice – Finger Print.

MODULE V DESIGNING ISSUES 9

Advancing the User Experience - The Timely User Experience - Documentation and User Support - Information Search - Data Visualization - Development of Smartphone - Self - reporting applications in Health Care.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Ben Shneiderman, Catherine, Maxine Cohen, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, 6th Edition, ISBN-9780134380711, 2017.

REFERENCES:

1. Scott Mackenzie, “Human Computer Interface: An Empirical Research perspective”, Elsevier, ISBN: 978012405865, 2013.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the basic concepts of user interface.

CO2: Develop effective communication and collaboration skills to work with stakeholders, healthcare professionals, and interdisciplinary teams to create impactful emotional interfaces.

CO3: Apply the design process to solve complex problems and create innovative solutions in various design domains.

CO4: Elucidate the importance of incorporating expressive human language and natural language processing in user interfaces.

CO5: Analyze the design issues in real time applications using User experiences.

Board of Studies (BoS) :
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M					M							M	
CO 2			M				M							L
CO 3								M	M	M		H	L	
CO 4			M	M				M					M	
CO 5						M					M			M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 :Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Statement: Learning of various statistical methods will lead to knowledge of applications in Data Science and Computing.

CSDX 230	USER INTERFACE DESIGN	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To expose the relation between interaction design and user‘s expectations.

COB2: To familiarize on user observation method and design process.

COB3: To learn about the prototype includes usability heuristics.

COB4: To emphasize effective user interface design techniques for posture and design.

COB5: To understand the concepts for development digital service for multiscreen design.

MODULE I INTERACTION DESIGN 9

Introduction, Good and Poor design, Interaction design, User experience, Process of Interaction design, Interaction design and User experience. Understanding the problem space and conceptualizing interaction, Interaction paradigms.

MODULE II DEVELOPMENT PROCESS 9

Managing design process – organizational design to support usability – Four phases of design – development methodologies – Ethnographical observation – Participatory design – scenario development. Develop System Menus and Navigation menus-Select the proper kinds of windows-Select the proper device based controls.

MODULE III PROTOTYPING AND CONSTRUCTION 9

Process of Interaction Design – Establishing Requirements – Design, Prototyping and Construction – Evaluation and Framework. Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation.

MODULE IV PLATFORM AND POSTURE 9

Designing Desktop Software ,Web sites, Web Applications, Internet-enabled Applications, Intranet – Other Platforms Handhelds, Kiosks, Television-based Interfaces, Automotive Interfaces, Appliances, Audible Interfaces.

MODULE V MULTISCREEN UX DESIGN 9

Four Screens – Context of use – Strategies – Mobile First, Simultaneity, Social TV, Device Shifting, Complementarity, Synchronization, Screen Sharing, Coherence, Fluidity, Smart Content, Communification, Mashability, Gamification – Hybrid Media– Technical Challenges. Case Study – Tool Study.

L – 45 ;TOTAL HOURS – 45

TEXT BOOKS:

1. Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist, and Nicholas Diakopoulos, “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, 6th edition, Pearson Education Limited, 2018.
2. Wilbert O. Galitz, “The Essential Guide to User Interface Design An Introduction to GUI Design Principles and Techniques” 3rd edition, Wiley Publishing, Inc., 2007.

REFERENCES:

1.Alan Cooper, Robert Reimann, and Dave Cronin, ”About Face 3 The Essentials of Interaction Design”, Wiley Publishing, Inc., 2007.
2.Wolfram Nagel, “Multiscreen UX Design Developing for a Multitude of Devices”, Elsevier Inc., 2013.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Define interaction design pattern for a particular user interface situation

CO2: Interpret the user inputs in design patterns development process.

CO3: Implement the interface prototypes based on the design process.

CO4: Analyze the user needs for developing appropriate interface design.

CO5: Apply the concepts UX for a real time application.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M												M	L
CO 2			L										M	L
CO 3					H				L				M	M
CO 4											M		M	L
CO 5										L			M	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: UX process when conducted efficiently assists in designing intuitive design with high usability in real world environment.

CSDX 231	SOFTWARE QUALITY ASSURANCE	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the evolution of quality concepts and the role of quality in software development.

COB2: To learn the software quality dimensions and specifications.

COB3: To acquire knowledge of validation and verification techniques, including software design validation and product validation.

COB4: To expose the importance of software quality metrics

COB5: To familiarize with the industry standards, quality control tools and frameworks of software quality assurance.

MODULE I QUALITY ASSURANCE BASICS 9

Quality and Reliability – Evolution of the concepts of Quality – Quality gurus – Total Quality Management – Costs of Quality - Quality in organizations – Quality goals –Current scenario in software development organizations.

MODULE II SOFTWARE QUALITY DIMENSIONS 9

Four Dimensions of Software Quality – Specification – Conformance – Design – Development – Ensuring Quality -Software Product Quality – Measurement of software quality.

MODULE III VERIFICATION AND VALIDATION 9

Verification – Walkthroughs – Inspections – Audits – Verification Process-Implementation of Verification activities in projects – Validation of Software Design - Specification – Product Validation.

MODULE IV PRODUCT AND PROCESS QUALITY 9

Software Product Quality - Process Quality – Improvement and Stabilization - Process Models - Components of a Process - Metrics for Software Quality - Process and Product Metrics.

MODULE V QUALITY PARADIGM AND STANDARDS 9

Current Certification Paradigms-Fallacy of Certifications – Maturity Models – New Paradigms for Software Quality Assurance. Quality management standards – ISO 9001 and 9000-3 – CMMI – SPICE- Tools for Quality improvement- Quality Control Tools.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Murali Chemuturi, — Mastering Software Quality Assurance: Best Practices, Tools and Techniques —, J.Ross Publishing, ISBN-978-1-60427-032-7.,2011.

REFERENCES:

1. Daniel Galin, “Software Quality Assurance: From Theory to Implementation”, Addison-Wesley, ISBN 0201709457, 2004.
2. Ivan Mistrik , Richard M Soley ,Nour Ali , John Grundy , Bedir Tekinerdogan, “Software Quality Assurance: In Large Scale and Complex Software- intensive Systems”, Morgan Kaufmann, ISBN – 0128023015,2015.
3. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit”, CRC Press, ISBN 149873555X, 9781498735551, 2016.
4. Schulmeyer, G. Gordon and McManus, James, “Handbook of Software Quality Assurance”, 3rd edition, Prentice Hall, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Identify quality goals and define the role of quality assurance in the software development process.

CO2: Define quality specifications and apply design principles to develop quality software products.

CO3: Apply verification techniques such as walkthroughs, inspections, audits and validate software product and design.

CO4: Measure and assess the product and process metrics to improve software quality.

CO5: Apply various quality control tools, standards and paradigms for software quality assurance.

Board of Studies (BoS) :	**Academic Council:**
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					L								M	
CO 2			M											H
CO 3		H												M
CO 4						L							H	M
CO 5										H			M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement :The complete understanding of building Software Quality Assurance leads to construction of quality software product for sustainable industrialization.

CSDX 232	SOFTWARE INTEGRATION AND MAINTENANCE	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the fundamental concepts of software integration approach.

COB2: To attain knowledge on systems integration methods.

COB3: To ensure the quality and evaluation of software product.

COB4: To recognize the concepts of software evolution and maintenance.

COB5: To explain the process of software re-engineering to improve the maintainability of a software system.

MODULE I INTRODUCTION **9**

Software Integration Strategy – Approach to Software Integration – Software Integration testing – Development facility – Software operations – Software Configuration – Software Integration setup - Software integration log – Software Test completion – Integration, verification and validation – Configuration, Reviews and Audits.

MODULE II SOFTWARE AND SYSTEMS INTEGRATION **9**

Software and Systems Integration Plan – Integration Facility – Integration Setup – Formal Engineering Build – Test Team – Quality participation in Software and Systems Integration – Effective Methods for Software and Systems Integration – Planning – Communication – Risk Management – Quality.

MODULE III SOFTWARE PRODUCT EVALUATION **9**

Quality Assurance – Product Evaluation Schedule – Artifacts – Audit Findings – Corrective Actions – Quality Metrics – Quality management System – Software Process – Stress Management Techniques – Solving Quality Issues.

MODULE IV SOFTWARE MAINTENANCE AND EVOLUTION **9**

Categories of Maintenance concepts – Evolution of software systems – Maintenance of Cots-Based systems – Maintenance Models – Reuse oriented model – Staged Model for Closed source software – Staged Model for Open source software – Change Mini-Cycle Model – IEEE/EIA Maintenance Process – ISO/IEC 14764 Maintenance Process – Software Configuration Management – CR Workflow.

MODULE V RENGINEERING **9**

Reengineering Concepts – General Model for Software Reengineering – Reengineering Process – Code Reverse Engineering – Techniques used for Reverse Engineering – Data Reverse Engineering – Reverse Engineering Tools.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Boyd L. Summers, “Effective Methods for Software and Systems Integration”, Auerbach Publications, 1st edition, 2012, (ISBN-13 : 978-1439876626).
2. Kshirasagar Naik and Priyadarshi Tripathy, “Software Evolution and Maintenance”, Wiley, 1st edition, November 2014, (ISBN-13: 9780470603413).

REFERENCES:

1. Ervin Varga, “Unraveling Software Maintenance and Evolution”, Springer Cham, 1st edition, 2017, (ISBN-13: 978-3-319-71303-8).

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe various types of software subsystems and its integration approaches.

CO2: Apply integration methods for data consistency and increased productivity in software systems.

CO3: Evaluate the quality of software product competing to industry standards.

CO4: Analyze software maintenance and evolution process in software systems

CO5: Elucidate complex design reengineering and reverse engineering techniques and its tools.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	L	L		L					L			L	L	
CO 2	L	L							L			L	L	
CO 3	L	L	L	L					M			L	L	L
CO 4	L	L	L	L	L				M			L	L	
CO 5	L	L	L	L	L				M			L	L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: The holistic understanding of integrating different systems and software applications by examining current emerging trends, strategies, and techniques for developing systems integration solutions effectively to preserve productivity and accurate data analysis and create adaptable highly dynamic applications and services.

CSDX 233	GAMING TECHNOLOGY	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To familiarize the fundamental principles of game design.

COB2: To learn elements of core game mechanics.

COB3: To acquire knowledge on designing game world environment.

COB4: To explore building the game with various technologies.

COB5: To educate game development using various tools.

MODULE I ART OF GAME DESIGN 9

Experience – Elements & Theme of game – Game begins with idea – Improves through iteration – agile – Risk assessment and prototyping – Player's mind.

MODULE II GAME MECHANICS 9

Elements of Game mechanics: Space – Time – Objects – Actions – Rules – Skill – chance - Game balance – Game mechanics supports puzzles.

MODULE III GAME WORLD 9

Interface – Story and Game structure in game world – Characters in game world – Aesthetics – Game design document – Play testing – Game for profit.

MODULE IV GAMING TECHNOLOGY 9

Build game with technology - Motion capture – Virtual Reality – Health & fitness games – Streaming – E-sports – Gaming & Learning – Future games.

MODULE V GAME DEVELOPMENT TOOLS 9

Game development using python – Game development tools - Working with Unity & Unreal engine: Scripting – Math – 2D & 3D graphics – Animation – Game play – Sound and Music – User interface – Cloud based gaming.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Jesse Schell , "The Art of game design", CRC press, 3rd edition, ISBN: 9781351803632, 1351803638, 2019.

2. John Wood ,"Gaming Technology", Gareth Stevens Publishing LLLP, ISBN : 9781538226414, 1538226413,2018.

REFERENCES:

1. Paris Buttfield-Addison ,"Unity game development cookbook", O'Reilly Media, ISBN: 9781491999127, 1491999128, 2019.
2. James R. Parker, "Game development using python", Mercury Learning & Information, ISBN : 9781683926252, 1683926250, 2021.
3. Hammad Fozi, Gonçalo Marques, David Pereira, Devin Sherry,"Game development projects with unreal engine", Packt Publishing,ISBN : 9781800203488, 2019.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Interpret the fundamental principles of game design.

CO2: Design game creatively from idea to prototype.

CO3: Apply story and game structure to create game world.

CO4: Identify and analyze building of game with various technology

CO5: Develop game codes using various technologies.

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Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	M												L	
CO 2			H			L							M	
CO 3									L				M	
CO 4		M			M							L	L	M
CO 5				M									M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning “Gaming technology”, the students are able to transform idea into gaming creatively, apply technology to design game and apply tools to develop games there by create profit that leads to sustainable economic growth, full and productive employment and decent work for all.

CSDX 234	COGNITIVE SCIENCE	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the domain of cognitive science.

COB2: To expose the integrated theory of visual attention.

COB3: To understand the role of linguistics in the formation of cognitive science.

COB4: To discover emotion-cognition interactions and affective computing.

COB5: To explore the state-of-the-art dynamical, embodied cognitive science.

MODULE I MIND AND PHILOSOPHY 9

Definition – Representation types – Computation – Tri-level hypothesis – Classical and connectionist views of computation – Various Approaches to Cognitive science - Reasoning - Philosophy – Mind body problem – Knowledge acquisition problem.

MODULE II VISION AND ATTENTION 9

Mind as an Information Processor -Modularity of Mind - Theories of Vision and Pattern Recognition - Feature Detection Theory - Theories of Attention - Models of Attention.

MODULE III MIND, LANGUAGE AND COGNITIVE SCIENCE 9

The Network Perspective - Semantic Networks: Meaning in the Web - Overall Evaluation of the Network Approach - The Linguistic Approach: The Importance of Language - Nature of Language - Language Use in Primates - Language Acquisition - Philosophy and Linguistics: The Linguistic - Neuroscience and Linguistics - Artificial Intelligence and Linguistics.

MODULE IV EMOTIONAL APPROACH 9

Emotion and Cognitive Science – Theories of Emotion – Basic Emotions – Emotions, Evolution and Psychological Disorders – Emotions and Neuroscience – Emotion-Cognition Interactions – Affective Computing – Evaluation of Emotional Approach

MODULE V ARTIFICIAL INTELLIGENCE APPROACH 9

Cognitive Science and Artificial Intelligence – Intelligent Agents – Fundamentals concepts – Learning experiences – Artificial General Intelligence – Reverse Engineering the Brain – Embodied Cognitive Science.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Jay Friedenberg, Gordon Silverman and Michael James Spivey, “Cognitive Science: An Introduction to the study of the Mind”, Sage Publishers, 4th edition, September 2021, (ISBN-13: 9781544380179).

REFERENCES:

1. Bernard J. Baars and Nicole M. Gage, “Cognition, Brain, and Consciousness: Introduction to Cognitive Neuroscience”, Elsevier Publication, 2nd edition, 2010, (ISBN : 978-0-12-375070-9).
2. Rom Harre, “Cognitive Science: A Philosophical Introduction”, Sage Publications, 1st edition, February 2002, (ISBN-13: 978-0761947479)

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Define cognitive science and relate its various disciplines.

CO2: Illustrate philosophical ideas with experimental neuroscience.

CO3: Emphasize the role of linguistics in the formation of cognitive science.

CO4: Analyze emotion-cognition interactions to influence cognitive processes in human.

CO5: Implement cognitive science and artificial intelligence for conceptual developments.

Board of Studies (BoS) :
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Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	L	L											L	
CO 2	L	L	M	L		L	L		L	L	L	L	L	
CO 3	L	L	M	L			L		M	L	L	L	L	
CO 4	L	L	H	M	H	L	L		M	L	L	L	L	
CO 5	M	L	H	M	H	L	L		M	L	L	L	L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The holistic understanding of the brain, mind and human cognitive functions leads to examine how cognitive science and technologies can build added value for developing country economy.

CSDX 235	**HIGH PERFORMANCE COMPUTER ARCHITECTURE**	**L**	**T**	**P**	**C**
SDG: 4		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To learn the fundamentals of high-performance computer architecture.

COB2: To explore the advanced processor technology and memory hierarchy.

COB3: To gain knowledge of pipelining and super scalar techniques.

COB4: To familiarize with parallel and scalable architecture.

COB5: To acquire understanding of High-Performance Computing Paradigms.

MODULE I INTRODUCTION 9

High-Performance Computer - Computing - The Modern Computer Performance Improvements - RISC processors – CISC - RISC Vs CISC - Levels of Parallelism - Models - Architectures: N-wide Superscalar Architectures - Multi-core - Multi-threaded.

MODULE II PROCESSOR AND MEMORY HIERARCHY 9

Advanced Processor Technology – Superscalar & Vector Processors – Memory Hierarchy Technology – Virtual Memory Technology – Bus Systems – Cache Memory Organizations – Shared Memory Organizations.

MODULE III PIPELINING AND SUPERSCALAR TECHNIQUES 9

Linear Pipeline Processors – Nonlinear Pipeline Processors – Pipeline Design – Arithmetic Pipeline Design.

MODULE IV PARALLEL AND SCALABLE ARCHITECTURE 9

Multiprocessor System Interconnects – Cache Coherence and Synchronization Mechanisms – Three Generations of Multicomputer – Message passing Mechanisms – Vector Processing Principles – Multivector Multiprocessors – Compound Vector Processing.

MODULE V HIGH-PERFORMANCE COMPUTING 9

High-Performance Computing Metrics – Paradigms: Super Computing – Cluster Computing – Grid Computing – Cloud Computing – Many-core Computing – Petascale Systems.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Jawad Haj-Yahya, Avi Mendelson, Yosi Ben Asher, Anupam Chattopadhyay, “Energy Efficient High-Performance Processors”, Springer Singapore 2018, ISBN 978-981-10-8553-6.
2. Victor Eijkhout, Edmond Chow, Robert van de Geijn, “Introduction to High Performance Scientific Computing”, 2nd edition, revision 2016.

REFERENCES:

1. Zbigniew J. Czech, “Introduction to parallel computing”, 2nd edition, Cambridge University Press,2016, ISBN: 9781107174399.
2. Kai Hwang, Naresh Jotwani, “Advanced Computer Architecture”, 2nd Edition, Tata McCraw Hill Education Private Limited, 2011, ISBN 978-0-07-070210-3.
3. William Stallings, "Computer Organization and Architecture - Designing for Performance", 10th Edition, Pearson Education, ISBN-13: 978013410613, 2015.
4. Ramesh Goankar, “Microprocessor architecture, programming and applications with 8085”, 6th edition, Penram International Publishing, ISBN: 978-8187972884, 2013.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Demonstrate the working principles of high-performance computer architecture.

CO2: Enumerate the various processor technology and memory hierarchy.

CO3: Illustrate the pipelining and superscalar techniques.

CO4: Emphasize the working principle of parallel and scalable architectures.

CO5: Apply high-performance computing techniques.

Board of Studies (BoS) :	**Academic Council:**
22nd BoS of CSE held on 17.08.2023	21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1		L											L	
CO 2				M									M	
CO 3			M										M	
CO 4			M										M	
CO 5					H									M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: The students will play a key role in advance computer architecture design discovery, knowledge creation and dissemination. They educate and equip young people with the knowledge, acquired by building various architectural design models.

CSDX 236	NATURAL LANGUAGE PROCESSING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamentals of natural language processing

COB2: To expose the use of CFG and PCFG in NLP

COB3: To learn the role of semantics of sentences and pragmatics

COB4: To study the NLP techniques to IR applications

COB5: To explore application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

MODULE I INTRODUCTION 9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

MODULE II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

MODULE III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

MODULE IV SEMANTICS AND PRAGMATICS 9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

MODULE V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Nitin Indurkhya and Fred J. Damerau, “Handbook of Natural Language Processing, Chapman and Hall/CRC Press”, second edition, 2010.
2. Daniel Jurafsky, James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech”, Pearson Publication, 2014.

REFERENCES:

1. Breck Baldwin, “Language Processing with Java and Ling Pipe Cookbook”, Atlantic Publisher, 2015
2. Richard M Reese, “Natural Language Processing with Java”, Oreille Media, 2015.
3. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Analyze given text with basic NLP concepts.

CO2: Identify PoS tagging and word level analysis.

CO3: Implement a rule-based system to tackle morphology/syntax of language.

CO4: Design a tag set to be used for statistical processing for real-time applications.

CO5: Interpret the use of different statistical approaches for different types of NLP applications.

Board of Studies (BoS) :
22nd BoS of CSE held on 17.08.2023

Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	H				L		H						M	
CO 2	L	M		M								L		M
CO 3	M	H			M		L	M				M	L	L
CO 4	L	M											M	
CO 5	M	H	L				M					L	M	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning this course, the student may be able to learn about the challenges and opportunities to NLP and in turn promote engineering growth and foster innovation.

CSDX 237	MULTICORE ARCHITECTURE	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce the fundamentals aechitecture of multicore architecture..

COB2: To understand the importance of shared memory in the underlying architecture

COB3: To learn the basic approach of synchronization.

COB4: To explore the emerging transactional approach to concurrency.

COB5: To expose the concept of parallel Programming

MODULE I INTRODUCTION 9

Definitions – Technological Aspects - Design Principles of Connected Devices - Fundamentals of IPv6 – Addressing and Protocols relevant to IoT - Smart Cities and Environments – Smart Metering - Applications in Security.

MODULE II FOUNDATIONS OF SHARED MEMORY 9

Register construction – Atomic snapshots – Power of Primitive Synchronization Operations - Universality of Concensus – Spin Lock and Contention.

MODULE III SYNCHRONIZATION 9

Monitors and Blocking Synchronization – Role of Locking – Concurrent Queues – ABA Problem – Concurrent Stacks and Elimination.

MODULE IV CONCURRENT DATA STRUCTURES 9

Counting, Sorting and distributed coordination – Concurrent hashing and Natural Parallelism – Multiprocessor Scheduling and Parallelism - Barriers – Transactional Memory.

MODULE V PARALLEL PROGRAM DEVELOPMENT 9

Two n-Body Solvers – Tree Search – Pthreads – OpenMP – MPI.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Maurice Herlihy, Nir Shavit, “The Art of Multiprocessor Programming”, Morganaufmann, 1st Edition, 2012, ISBN: 978-0-12-370591-4.
2. Peter Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann,1st Edition, 2011, eBook ISBN: 978-0-080-92144-0.

REFERENCES:

1. Yan Solihin, “Fundamentals of Parallel Multicore Architecture”, Solihin CRC Press,2016 ,ISBN 13: 978-1-4822-1118-4.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Interpret the fundamental of multiprocessor programs and identify the protocols relevant to IoT application

CO2:Compare and contrast various parallel algorithms using shared memory

CO3: Demonstrate synchronization and parallelism

CO4: Apply barriers to concurrent real time applications

CO5: Analyze the results for various multiprocessor scheduling

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M			L									L	
CO2		M											M	
CO3	L												L	M
CO4	M		M						M				L	
CO5		H											M	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 :Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning the Multicore Architecture, the students are able to identify their characteristics and challenges and design parallel programming solutions to common problems.

CSDX 238	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the foundation on principles and characteristics o fservice oriented architecture.

COB2: To understand the importance of SOA in application integration

COB3: To explore SOA, service-orientationandservicecomposition.

COB4: To gain knowledge on web service modeling process.

COB5: To study service oriented design process.

MODULE I SOA BASICS 9

An Overview of SOA & Service – Orientation – Applying Service - Orientation -Principles of Service - Orientation - Characteristics of SOA -Types of SOA – SOA Design Patterns – Goals of Applying Service - Orientation-Planning for and Governing SOA - Pillars of Service - Orientation - Seven Levels of Organizational Maturity.

MODULE II SERVICE COMPOSITION 9

Basic Concepts - Service Models and Service Layers - Service and Service Capability Candidates – Breaking down the business problem –Functional decomposition – Service encapsulation – Agnostic Context - Non-Agnostic Context – Process Abstraction and Task Services - Building Up the Service-Oriented Solution – Service Composition.

MODULE III SERVICE TECHNOLOGY 9

An Overview of Service Technology - Web-Based Services - SOAP-Based Web Services - Components - Service Virtualization - Cloud Computing - Semantic Web - Business Process Management - Social Network Technologies -Mobile Computing – Agent - Driven Architecture - Business Intelligence - Big Data – Service - Driven Industry Models -The Enterprise Service Model – The Virtual Enterprise Model.

MODULE IV ANALYSIS AND MODELING WITH WEB SERVICES 9

Web Service Modeling Process- Decompose the Business Process- Filter Out Unsuitable Actions- Define Entity Service Candidates- Identify Process-Specific Logic- Identify Service Composition Candidates- Analyze Processing Requirements- Define Utility Service Candidates- Define Micro service Candidates- Apply Service – Orientation - Case Study

MODULE V SERVICE API AND CONTRACT DESIGN 9

Service Model Design Considerations- REST Service Design Guidelines- Uniform Contract Design Considerations- Designing and Standardizing Methods-Designing and Standardizing HTTP Headers- Designing and Standardizing HTTP Response Codes- Customizing Response Codes- Designing Schemas for Media Types- Stateless Complex Methods.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Thomas Erl, Paulo Merson and Roger Stoffers, “Service-Oriented Architecture Analysis and design for services and Microservices”, Prentic Hall Service Tech Press - ISBN-13: 978-0-13-385858-7, 2017.
2. Thomas Erl, Pethuru Chelliah, Clive Gee, Jürgen Kress, Berthold Maier, Hajo Normann, Leo Shuster, Bernd Trops, Clemens Utschig, Philip Wik, Torsten Winterberg, “Next Generation SOA: A Concise Introduction to Service Technology & Service-Orientation”, PHS Series, 1st Edition, ISBN : 9780133859041, 2015.

REFERENCES:

1. Alex Belot serkovskiy, Stephen Kaufman,NikhilSachdeva, “BuildingWebServiceswithMicrosoftAzure”,Packtpublishing,1stedition,ISBN:9781784398, 2015.
2. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser, “Perspectives on WebServices: Applying SOAP, WSDL and UDDI to Real-World”, Springer, 2ndEdition, ISBN:9783642624681,2012.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the service orientation principles and business modeling.

CO2: Analyze theunderlying technologyforservicedesign.

CO3: Develop design standardsforSOAbased solutions.

CO4: Design web services using current technologies.

CO5: Apply SOA concepts to real world problems

Board of Studies (BoS) :

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Academic Council:

21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		M											H	
CO2				H									L	
CO3						L								M
CO4			M							M			L	
CO5					H					L			L	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 :Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Statement: By learning “Service Oriented Architecture”, students can Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools which promotes the sustainable economic growth with productivity and employment.

SEMESTER VII

		L	T	P	C
CSDX 121	**GRAPH THEORY AND ITS APPLICATIONS**				
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To gain knowledge on undirected and directed graph types and representations

COB2: To understand graph connections in various applications.

COB3: To learn the importance of trees in graph theory.

COB4: To improve the ability to convert the real-life problems to graph models.

COB5: To impart knowledge on applying graph algorithms in Network flow applications.

MODULE I INTRODUCTION TO GRAPHS 8

Fundamentals of graph – Types of Graphs – Degree – History of Graph – Konigsberg Problem –– Basic Digraph models and Properties – Directed and Undirected graph representation – Incidence Matrix - Adjacency matrix and list – Isomorphism

MODULE II GRAPH CONNECTIVITY 9

Connected Graphs, Disconnected Graphs and Components - Walks, Paths and Circuits – Cut Set – Cut Vertices - Eulerian Graphs and its Applications - Chinese Postman Problems – Hamiltonian Graphs and its Applications – Traveling Salesman Problems – Shortest path Algorithm

MODULE III TREES 10

Properties of Trees –Rooted Trees - Spanning Trees in a graph and weighted graph – Minimum Spanning Tree –Depth First Spanning Tree and Breadth First Spanning Tree in graph – Tree Traversal – Expression Trees - Searching and Spanning Algorithms - Fundamental Circuit – Fundamental Cut Set

MODULE IV COLORING AND PARTITIONING 9

Graph coloring – Chromatic number – Chromatic Partitioning – Coloring Application – Timetabling – Scheduling - The Four Color Problem – Independence and Cliques – Graph Coloring Algorithms

MODULE V NETWORKS AND ITS APPLICATIONS 9

Network flow –Max-Flow and Min-Cut Theorem – Maximum flow algorithm - Dual Problem – Minimum Cost flow – Activity Networks in Project Planning – Graphs in Game Theory – Other applications.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Narsing Deo, “Graph Theory with Applications to Engineering & Computer Science”, Dover Publications, ISBN-13: 978-0486807935, 2016.
2. A Bondy and U S R Murty, ‘Graph Theory with Applications, Macmillan Press Ltd.’,ISBN: 0-444-19451-7, 1976.
3. Douglas B West, ‘Introduction to Graph Theory’, Prentice Hall of India, 2002.
4. Harary F, ‘Graph Theory’, Narosa Publishing House, New Delhi, 1989.

REFERENCES:

1. “Handbook of Graph Theory”, Ping Zhang, Jay Yellen, Jonathan L. Gross, Chapman and Hall/CRC, 2nd Edition, ISBN: 9781439880197, 2015.
2. “Advanced Graph Theory and Combinatorics, Michel, John Wiley & Sons, ISBN: 9781848216167, 2016.

COURSE OUTCOMES:

The students who complete the course will be able to

CO1: Compare the properties of directed and undirected graphs.

CO2: Solve graph connectivity problems in various applications.

CO3: Convert the graph in to tree and implement various tree algorithms to find solutions for graph theory applications.

CO4: Apply the principles and concepts of graph theory in real-life problems.

CO5: Design network based models and provide solutions to find maximum flow and minimum cost of networks.

Board of Studies (BoS) :

22nd BoS of CSE held on 17.08.2023

Academic Council:

21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	M	L	L									M	M	L
CO2	H	M	M										H	L
CO3	M		L		M						L			
CO4	M		M		M	M						M		
CO5			M								M		H	

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement : The student can design a new network model for various applications and provide solutions for different real-life problems.

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CSDX 122	QUANTUM COMPUTING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basics of quantum computation.

COB2: To explore capabilities and limitations of quantum computers.

COB3: To understand quantum model of computation in universal gates.

COB4: To gain knowledge on quantum algorithms for polynomial and amplification.

COB5: To expose the information on computational complexity theory, quantum error correction and recovery.

MODULE I INTRODUCTION **9**

Overview, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation, linear algebra and the Dirac notation: The Dirac Notation and Hilbert Spaces, Dual Vectors, Operators, The Spectral Theorem, Functions of Operators, Tensor Products, The Schmidt Decomposition Theorem.

MODULE II QUANTUM MODEL OF COMPUTATION **9**

The Quantum Circuit Model, Quantum Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits, Superdense Coding, Quantum Teleportation, An Application of Quantum Teleportation.

MODULE III QUANTUM ALGORITHMS **9**

Probabilistic Versus Quantum Algorithms, Phase Kick-Back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm, Quantum Phase Estimation and the Quantum Fourier Transform, Eigenvalue Estimation, Finding-Orders¸ Finding Discrete Logarithms¸ Hidden Subgroups.

MODULE IV QUANTUM COMPUTATIONAL COMPLEXITY THEORY & AMPLITUDE AMPLIFICATION **9**

Computational Complexity, The Black-Box Model, Lower Bounds for Searching in the Black-Box Model: Hybrid Method, General Black-Box Lower Bounds, Polynomial Method, Block Sensitivity, Algorithms based on amplitude amplification: Grover's Quantum Search Algorithm, Amplitude Amplification, Quantum Amplitude Estimation and Quantum Counting, Searching Without Knowing the Success Probability.

MODULE V QUANTUM ERROR CORRECTION 9

Quantum error correction: Classical Error Correction, The Classical Three-Bit Code, Quantum Error Correction¸ Three- and Nine-Qubit Quantum Codes, Fault-Tolerant Quantum Computation.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Phillip Kaye, Raymond Laflamme and Michele Mosca., “An introduction to Quantum Computing”, Oxford University press, 2007.
2. Chris Bernhardt, “Quantum Computing for Everyone”, The MIT Press, Cambridge, 2020.
3. David McMahon, “Quantum Computing Explained”, Wiley-Interscience, IEEE Computer Society, 2008.

REFERENCES:

1. M. A. Nielsen and I.Chuang ,”Quantum Computation and Quantum Information” , Cambridge University Press, 2013.
2. Eleanor G. Rieffel and Wolfgang H, “Quantum Computing, A Gentle Introduction” , Polak MIT press, 2014.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Learn the basics of quantum computation.

CO2: Apply quantum model of computation in universal gates

CO3: Attain knowledge on quantum algorithms for solving problems with complexity.

CO4: Analyze computational complexity for problems into variety of classes.

CO5: Evaluate quantum error correction and recovery

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	M				L									
CO 2			M											
CO 3		H						M						M
CO 4													H	
CO 5										H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement : The student can design a new computing model for various applications and provide solutions for different real-life problems.

CSDX 123	GREEN COMPUTING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.

COB2: To examine the power management in computing devices.

COB3: To emphasize skill in energy saving practices in their use of hardware.

COB4: To explore the technology tools that can reduce paper waste and carbon footprint.

COB5: To understand how to minimize equipment disposal requirements.

MODULE I INTRODUCTION **9**

Reputation as Motivation-Avoiding Green wash-Green Recruiting and Retention-Money saving efforts-Implementing Energy Efficiency-Current Devices –Digitizing NON-IT Functions.

MODULE II GREEN COMPUTING ENVIRONMENT **9**

Environmental Drivers-Green Agenda-Roots of Environmentalism-Environmentalism and IT-Imperative of Climate Change-Go Green-A New vision of Computing-Efficiency and cloud Computing-Green ability-responsibility-usability-the Zen of green computing

MODULE III GREEN DEVICES **9**

Device purchases-Dimension of Device pyramid greenness-Green computing-Embodied Energy-Device Green-Supplier Green-Buying principles-Desktop computers-Laptops.

MODULE IV GREEN DATACENTERS **9**

Green Data Centers – Model - Power supply considerations – servers – storage - networking - datacenter suppliers - saving Energy-Cost Savings - Risk Reduction - Carbon Footprint Reduction-Focusing on solar power.

MODULE V FUTURE AND REDUCTION OF GREEN HOUSE GAS AND RESOURCE USAGE **9**

Sources and sinks of greenhouse gases and Warming-Planned Obsolescence and Resource Use- Deep Green Computing.

L – 45;TOTAL HOURS-45

TEXT BOOKS:

1. Bud E. Smith,"Green Computing: Tools and Techniques for Saving Energy, Money, and Resources",CRC Press,1st Edition,ISBN:9781466503410,2014

REFERENCES:

1. Wu Chun Fang, "Green computing Book", CRC Press,1st Edition, ISBN:9781439819876, 2014.
2. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journeyll, Shroff/IBM rebook, 2011.ISBN-13: 978-0470587522

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Describe the resources pertaining to greenhouse gases and warming.

CO2: Develop energy efficient computing applications.

CO3: Analyze the consumption of power in data centers.

CO4: Evaluate deep green computing use in relation to environmental perspectives.

CO5: Discuss how the choice of hardware and software can facilitate a more sustainable operation.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H	L	M	L		H						M	H
CO2			H				H					L	M	H
CO3		H					H	M						
CO4				H			H					H	L	M
CO5	L		M				H			H			H	L

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG No.9:Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

Statement: The holistic understanding of green computing leads to construction of resilient infrastructure and sustainable industrialization.

CSDX 124	SECURITY EVALUATION AND	L	T	P	C
SDG: 9	ASSESSMENT METHODOLOGY	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basic principles of security evaluation process.

COB2: To explore the right penetration technique for a given situation

COB3: To expose appropriate strategies to assure confidentiality, integrity, and availability of information.

COB4: To gain knowledge on components and basic requirements for creating a security policy framework.

COB5: To .study the key elements of reorting and assessment findings.

MODULE I OVERVIEW 09

Introduction to Security Evaluation – Policies, standards, guidelines – elements and Development – Evaluation Criteria.

MODULE II PRE EVALUATION 09

Setting Expectations – Scoping the Evaluation – Legal Principles for Security Evaluation – building the Technical Evaluation Plan.

MODULE III ONLINE AND POST EVALUATION 09

How to start Onsite Efforts – Network Discovery Activities – fine tuning the Evaluation – Post Evaluation Analysis – Trending Metrics – final Reporting

MODULE IV SECURITY COMPONENT FUNDAMENTALS FOR ASSESSMENT 09

Importance - Process – Methods – Techniques- Management Controls – Security Services Life Cycle – Physical and Personnel security –wireless Networking.

MODULE V EVIDENCE OF ASSESSMENT AND REPORTING 09

Evidence Types – Documentation Requirements – Key elements of Reporting – Assessment Findings – Security assessment report – risk assessment report – Artifacts as reports – Executive Summary .

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Leighton Johnson, ―Security Controls Evaluation, Testing, and Assessment Handbook‖, Elsevier Publishers, 1st Edition, ISBN: 9780128023242, 2015.

REFERENCES:

1. SudhanshuKairab,A Practical Guide to Security Assessment‖, Auerbach Publications , CRC press,1st Edition, ISBN: 9780849317064,2007.
2. Debra.S.Herrman, ―Using the Common Criteria for IT Security Evaluation‖, Auerbach Publications , CRC press,1st Edition, ISBN:0849314046,2005.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Document the core issues and requirements in building secure and effective networks systems

CO2: Assess existing systems using the theories, techniques, and software tools that are available in the field of information security and computer networks

CO3: Analyze issues and solutions in security and network design as they affect general and particular communities

CO4: Evaluate and assess the components of assessment.

CO5: Apply and operationalize network security technologies and techniques.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2
CO1	L				L				L					M
CO2														
CO3		H			M			M		H			M	
CO4														
CO5										H				L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No. 9: Industry Innovation and Infrastructure.

Statement: Promote inclusive and sustainable industrialization, enhance research and upgrade the technology. streamlines a system by removing human inputs, which decreases errors, increases speed of delivery, boosts quality, minimizes costs, and simplifies the business process.

CSDX 125	**5G WIRELESS COMMUNICATION**	**L**	**T**	**P**	**C**
SDG: 9	**TECHNIQUES**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide an overview of fifth-generation (5G) wireless communications systems.

COB2: To impart knowledge about the 5G enabler mmWave Spectrum

COB3: To expose the students to the radio-access technologies.

COB4: To acquaint students with various types of relaying and coding techniques

COB5: To improve students' understanding of 5G spectrum and Channel model.

MODULE I HISTORICAL BACKGROUND 09

Introduction - Historical background - From ICT to the whole economy - Rationale of 5G - Global initiatives - Standardization activities - 5G use cases and system concept - Use cases and requirements -Requirements and key performance indicators - 5G system concept - Concept overview - Extreme mobile broadband- Massive machine-type communication - Ultra-reliable machine-type communication .

MODULE II 5G ARCHITECTURE 09

Introduction - High-level requirements for the 5G architecture - Functional architecture and 5G flexibility - Physical architecture and 5G deployment - Machine-type communications - Fundamental techniques for MTC - Massive MTC - Ultra-reliable low-latency MTC - Device-to-device (D2D) communications - D2D: from 4G to 5G - Radio resource management for mobile broadband D2D - Millimeter wave communications - Spectrum and regulations - Channel propagation.

MODULE III RADIO ACCESS TECHNOLOGIES 09

The 5G radio-access technologies - Access design principles for multi-user communications - Multi-carrier with filtering: a new waveform - Non-orthogonal schemes for efficient multiple access - Radio access for V2X communication - Radio access for massive machine-type communication - Massive multiple-input multiple-output (MIMO) systems - Theoretical background - Pilot design for massive MIMO - Fundamentals of baseband and RF implementations in massive MIMO - Channel models.

MODULE IV RELAYING AND WIRELESS NETWORK CODING 09

The role of relaying and network coding in 5G wireless networks - Multi-flow wireless backhauling - Highly flexible multi-flow relaying - Buffer-aided relaying - Interference management, mobility management, and dynamic reconfiguration - Network deployment types - Interference management in 5G - Mobility management in 5G - Dynamic network reconfiguration in 5G.

MODULE V 5G SPECTRUM 09

Spectrum challenges in 5G - 5G spectrum landscape and requirements - Spectrum access modes and sharing scenarios - 5G spectrum technologies - Value of spectrum for 5G: a techno-economic perspective - The 5G wireless propagation channel models - Modeling requirements and scenarios - Overview of a Potential 5G Communications -System Architecture.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. MischaDohler, Jose F. Monserrat, AfifOsseiran, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 1st Edition, ISBN: 9781316653166, June 2016.

REFERENCES:

1. Jonathan Rodriguez ,’Fundamentals of 5G Mobile Networks, John Wiley & Sons, Ltd., 1st Edition, ISBN: 9781118867525,2015.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Describe the rationale of 5G communications.

CO2: Illustrate the limitations of current networks as well as the requirements of the next generation, motivated by the vertical industries

CO3: Analyze the foreseen architecture for 5G, harness all the common views on the current technology trends and the emerging applications

CO4: Evaluate the benefits and detriments of 5G wireless communication.

CO5: Compose a report with recommendations for an use case

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2
CO1	L				L				L					M
CO2														
CO3		H			M			M		H			M	
CO4														
CO5										H				L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No. 9: Industry Innovation and Infrastructure.

Statement : The student can design a new network model for various 5G wireless communication and provide solutions for different real-life problems.

CSDX 126	FULL STACK MOBILE APPLICATION DEVELOPMENT II (BACK END)	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand of the server side processes in the web.

COB2: To study the steps in retrieval of data from the back end

COB3: To expose the file processing operations.

COB4: To learn the overview of the ExpressJS middleware.

COB5: To explore the role of MongoB in web processing.

MODULE I NODE JS BASICS & I/O 10

Basics –Web development Framework – Role of Browser – NodeJS to Angular JS components - Installation – Creation – Writing data to console – Event model – Adding work to event queue –Implementing Callbacks - Working with JSON - Buffer data – Stream data - Opening and Closing Files - Writing Files - Reading Files - Other File System Tasks – Examples.

MODULE II SERVICES IN NODEJS 9

Processing URLs - Processing Query Strings and Form Parameters - Understanding Request, Response, and Server Objects - Implementing HTTP Clients and Servers in Node.js - Implementing HTTPS Servers and Clients - Understanding Network Sockets - Understanding TCP Server and Socket Objects - Implementing TCP Socket Servers and Clients - Implementing TLS Servers and Clients.

MODULE III EXPRESSJS 7

The core parts of Express – Middleware- Routing – Sub applications - Conveniences - The ecosystem surrounding Express - Express vs. other web application frameworks - What Express is used for - Third-party modules for Node.js and Express – Example App.

MODULE IV NOSQL AND MONGODB 10

NoSQL basics – Building the MongoDB Environment - Administering User Accounts - Configuring Access Control - Administering Databases - Managing Collections - Understanding Database Change Options - Understanding Database Update Operators- Adding Documents to a Collection - Getting Documents from a Collection - Updating Documents in a Collection - Atomically Modifying Documents in a Collection - Saving Documents in a Collection - Using upsert to Insert Documents in a Collection - Deleting Documents from a Collection - Removing a Single Document from a Collection.

MODULE V NODEJS AND MONGODB 9

Understanding Query Objects - Understanding Query options Objects - Finding Specific Sets of Documents - Counting Documents- Limiting Result Sets - Sorting Result Sets - Finding Distinct Field Values - Grouping Results - Applying MapReduce by Aggregating Results - Adding Indexes - Using Capped Collections - Applying Replication - Implementing Sharding.

L – 45; TOTAL HOURS – 45

TEXTBOOKS AND REFERENCES:

1. Brad Dayley, Node.js, MongoDB and AngularJS Web Developmentll, Addison Wesley, ISBN-10: 0321995783, 2014.
2. Evan M Hahn, Express in Action: Writing, building and testing NodeJS application, Manning Publications, ISBN 9781617292422, 2016.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Implement a highly scalable and dynamic webserver, using Node.js and Express.

CO2: Provision a MongoDB data store for the web applications.

CO3: Access and interact with MongoDB from Node.js JavaScript code.

CO4: Implement client-side services that can interact with the Node.js webserver.

CO5: Build dynamic browser views that provide rich user interaction with authenticated user accounts.

Board of Studies (BoS) :
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Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO2
CO1			L										L	
CO2				L									M	
CO3				M									M	
CO4											M			M
CO5											H			M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No 4: Industry, Innovation & Infrastructure
Build the novelty for application innovations and industrial development.

Statement :The holistic understanding of application development terminologies and components leads to the construction of resilient infrastructure and sustainable industrialization.

CSDX 127	WEB HACKING AND SECURITY	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To expose web app security loopholes (vulnerabilities) and their exploitation techniques.

COB2: To understand the principles of web hacking and guarantee a secure network by monitoring and analyzing the nature of attacks through tools.

COB3: To learn operational and strategic web hacking strategies and policies.

COB4: To explore methods to identify, analyze, and remediate computer security breaches.

COB5: To understand the vulnerabilities present in web applications.

MODULE I HTML INJECTION AND CROSS-SITE SCRIPTING (XSS) 9

Web sockets-Web storage-Web workers-Understanding HTML injection-Identifying Points of Injection-Identifying the types of Reflection- Identifying the Injection's Rendered interest-Abusing Character set-Exploiting the failure modes--Employing Counter measures-Fixing a static character set-Normalizing character sets and encoding-Encoding the output.

MODULE II CROSS-SI REQUEST FORGERY AND SQL INJECTION 9

UnderstandingCross-Site Request Forgery (CSRF)--Request Forgery via forced browsing-Attacking authenticated actions without password-Dangerous liaison-Understanding SQL injection-Hacking Tangents-Breaking SQL statements-Vivisecting the Database-Alternate attack vectors--Employing Counter measures-Heading in the Right Direction-Defending the web browser.

MODULE III BREAKING AUTHENTICATION SCHEMES AND BROWSER & PRIVACY ATTACKS 9

Understanding authentication attacks-Replaying the session token-Brute forcing-Sniffing-Cross site Scripting-Employing Counter measures-Understanding Malware and browser attacks-Malware-Plugging into Browser plugins-DNS and origins-Employing Counter measures-Configure SSL/TLS securely-Safe Browsing-Isolating the Browser-Tor.

MODULE IV SECURING MODERN WEB APPLICATIONS 9

Introduction to Securing modern web applications-Secure Application Architecture-Reviewing code for security-Vulnerability Discovery-Vulnerability management.

MODULE V DEFENDING AGAINST ATTACKS 9

Defending against XSS Attacks-Defending against CSRF Attacks-Defending against XXE-Defending against Injection-Defending against DoS-Securing Third party Dependencies.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Shema, Mike. Hacking Web Apps: Detecting and Preventing Web Application Security Problems. Netherlands, Elsevier Science, 2012. SBN:9781597499514.
2. SINGH, Abhishek. Web Hacking 101: Books for White Hat Hackers, Independently Published, 2020,ISBN:9798673551653.
3. Hoffman, Andrew. Web Application Security: Exploitation and Countermeasures for Modern Web Applications. , O'Reilly Media, 2020,ISBN:9781492053088.

REFERENCES:

1. Hatcher, Jacob. Hacking: Hacking For Beginners and Basic Security: How To Hack.., Lulu.com, 2016, ISBN:9781329837294.
2. McDonald, Malcolm. Web Security for Developers: Real Threats, Practical Defense. United States, No Starch Press, 2020, ISBN:9781593279943.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Examine how attackers to gain access to useful and sensitive information about confidential data can do social engineering.

CO2: Describe various techniques and tools used in web hacking

CO3: Analyze the characteristics of the enumeration phase of an attack and effective countermeasures

CO4: Illustrate the web security needs of an organization

CO5: Implement, and monitor web security mechanisms to help ensure the protection of information technology assets.

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Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1			L										L	
CO2			L				M				L			
CO3			L				M				L			
CO4			L								L			
CO5						M							L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG NO 9 : Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Statement :
Build industrial practices combined with the latest smart technology for digitally enhanced manufacturing.

CSDX 128	SOCIAL MEDIA SECURITY	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore the overview of social media fundamentals

COB2: To provide various opportunities of social media

COB3: To emphasize the risks present in social media and how to Mitigate them

COB4: To focus on security issues with commonly used social network

COB5: To explore the policy and privacy frame work that addresses the social media risks

MODULE I INTRODUCTION TO SOCIAL MEDIA **9**

Social media – Types and classification – Value of social media - Social media concepts and theories – Social network sites

MODULE II OPPORTUNITIES OF SOCIAL MEDIA **9**

Marketing – Sharing information – Blogs – Video calls - Employment – Limiting personal information in LinkedIn - Uses of social media in public sector.

MODULE III RISKS OF SOCIAL MEDIA **9**

Create social media applications - Risks of Social Media – Public embarrassment – False information – Information leakage – Backing up social media – Loss of data/equipment – Cybercrime – Social Engineering – Hacked accounts.

MODULE IV RISK MANAGEMENT **9**

Risk management – Laws and Regulation – Insurance – Forensics – Police use of social media– monitor social media – best practices & security tools – Malware, Viruses and exploit distribution – Risk management model.

MODULE V POLICIES AND PRIVACY **9**

Policies-Privacy Blocking users on Facebook, Twitter, YouTube, WhatsApp – Controlling app privacy in Facebook - Location awareness in Facebook and Twitter- Case studies

L 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Dac-Nhuong Le, Chintan Bhatt, Mani Madhukar," Security Designs for the Cloud, IoT, and Social Networking", ISBN 1119593204, 9781119593201,John Wiley & Sons, 2019.
2. Jeremy Harris Lipschultz," Social Media Communication: Concepts, Practices, Data, Law and Ethics",2nd Edition, ISBN 131538812X, 9781315388120,Routledge Publication , 2017

REFERENCES:

1. Michael Cross," Social Media Security: Leveraging Social Networking While Mitigating Risk", ISBN 1597499870, 9781597499873, Newnes Publication, 2013.
2. Deborah Gonzalez," Managing Online Risk: Apps, Mobile, and Social Media Security", ISBN 0124200605, 9780124200609 Butterworth-Heinemann, 2014.
3. Alan Oxley," Security Risks in Social Media Technologies: Safe Practices in Public Service Applications", ISBN 1780633807, 9781780633800, Elsevier, 2013.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Describe functions of various social media networking sites.

CO2: Identify the use of social media applications in the public sectors.

CO3: Acquire knowledge on risk of social media and mitigate the risks

CO4: Analyze dark side of social media and to take preventive measures

CO5: Document the policies and privacy framework of various social networks

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Academic Council:
21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2
CO1	M		L				-	-	-	-			H	
CO2		H	H	M			-	L	-	-				H
CO3				L	L		-	-	-	M			H	
CO4	M				H	L	-	-	-	-	L		L	
CO5	M	L	L	M	L		-	-	-	M	L		H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of Social media security for Social media types, risks of social media, Public embarrassment, risk management, virus and exploit distribution, Loss of data/equipments.

CSDX 129	MULTIMEDIA SECURITY	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the basic digital rights management systems.
COB2: To study the possible counter measures against threats and vulnerabilities in a given security scenario.
COB3: To learn the requirements and mechanisms for identification and authentication
COB4: To explore the underlying security mechanisms needed to implement security countermeasures.
COB5: To have a deeper knowledge on embedded concepts of multimedia security**.**

MODULE I FUNDAMENTALS OF MULTIMEDIA SECURITY 9

Overview of Digital rights management systems, Putting Digital rights management in context, multimedia encryption, multimedia authentication, key management for multimedia authentication and distribution.

MODULE II MULTIMEDIA SECURITY APPLICATIONS 9

An overview of Digital watermarking, Biometrics in Digital rights management, Steganalysis, passive blind image forensics, security in digital cinema

MODULE III EMBEDDED MULTIMEDIA SECURITY 9

Video coding, embedded systems and reconfigurable architectures and encryption basics.

MODULE IV MULTIMEDIA MINING AND CLASSIFICATION 9

Multimedia Duplicate Mining toward Knowledge Discovery, Discriminative Learning – Assisted Video Semantic concept classification, Improved Feature Vocabulary-Based Method for Image Categorization

MODULE V FORENSICS 9

Image Inpainting using an Enhanced Exemplar- Based algorithm, Image Forgery Detection, Chaos based Hash function with Modification Detection and Localization Capabilities, Behavior Modeling of Human Objects in Multimedia Content

L – 45 ; TOTAL HOURS – 45

TEXTBOOKS AND REFERENCES:

1. Wenjun Zeng, Heather Yu, Ching-Yung Lin, “Multimedia Security Technologies for Digital Rights Management”, Academic Press, 2nd edition, ISBN: 9780123894768, 2011.
2. Amit Pande, Joseph Zambreno,” Embedded Multimedia Security Systems: Algorithms and Architectures”, Springer Science & Business Media, 2nd edition, ISBN:1447144597, 2012.
3. Frank Y.Shih, ”Multimedia Security: Watermarking, Steganography, and Forensics”, CRC press, Taylor & Francis Group

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Describe the digital rights management systems in multimedia security.

CO2: Illustrate the requirements and mechanisms for identification and authentication in multimedia systems.

CO3:.Demonstrate the need for embedded multimedia security using a real time case study.

CO4: Apply multimedia mining in various multimedia applications.

CO5: Compare and contrast security mechanisms needed to implement security in multimedia

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Academic Council: 21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M				L									
CO2			M											
CO3		H						M						M
CO4													H	
CO5										H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

Statement :

Build industrial practices combined with the latest smart technology for digitally enhanced manufacturing.

CSDX 130	MULTIMEDIA COMMUNICATION AND NETWORKING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the principles and standards of multimedia.

COB2: To understand the multimedia internet protocols in networking.

COB3:.To explore various paradigms of compression techniques

COB4: To expose on the basic idea and structure of switching networks

COB5: To exemplify the features of a multimedia system and identify its suitability for the given task

MODULE I INTRODUCTION 7

Introduction- Multimedia networks - Multimedia applications- Applications and networking terminology – components of multimedia – file format of multimedia system.

MODULE II MULTIMEDIA COMPRESSION TECHNIQUES 10

Quantization – Non-Linear Quantization- Differential encoding – Linear Prediction coding – Differential pulse code modulation – Lossless Compression – Run length coding –Huffman Coding – Lossy Compression – Direct cosine transform – Wavelet transform – Compression standards.

MODULE III INTERNET SERVICES 9

IP datagrams -Fragmentation and reassembly-IP addresses- ARP and RARP - Routing algorithms – ICMP- QoS Services-IPv4- IPv6 - Transport protocols -UDP- RTP and RTCP.

MODULE IV BROADBAND ATM NETWORKS 9

Cell format - switching principles – Switch and Protocol architecture - entertainment networks and high speed modems- Cable TV networks- Satellite television networks-Terrestrial television networks.

MODULE V COMMUNICATIONS ACROSS NETWORKS 10

Packet Audio and Video in the network environment - Video transport across generic networks - transport across ATM networks – Multimedia across IP networks – Multimedia across DSLs – Internet access Networks – Multimedia across wireless mobile networks.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Kumar Krishna, Multimedia Communication, Pearson Education India, ISBN: 978-81-317-3238-0, 2010.
2. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols, and Standards, Pearson Education,Fourth Edition, ISBN: 978-81-317-0994-8, , 2009.

REFERENCES

1. C. T. Bhunia, “Multimedia and Multimedia Communication”, New Age International, ISBN: 81-2242-660-3, 2009.
2. Hans W. Barz, Gregory A. Bassett,” Multimedia networks”, Wiley, ISBN : 9781119090137, 111909013X, 2016.

COURSE OUTCOMES :

After completion of the course, students will be able to

CO1: Illustrate state of art techniques in multimedia communication.

CO2: Choose the appropriate compression technique for the given scenario.

CO3: Analyze the functions of various transport protocols.

CO4: Identify and solve problems in the fields of communication and networks.

CO5: Design the communication and networking systems to meet desired specification.

Board of Studies (BoS) :

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Academic Council:

21st AC held on 20.12.2023

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1			H											
CO2					L								H	
CO3						L								
CO4							L							
CO5								M						M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG No.8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

The student can design a new network model for various wireless communication and provide solutions for different real-life problems.

CSDX 131	API DESIGN	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the types of web services, resources, APIs and their architectures

COB2: To study the web service / API design patterns

COB3: To acquire knowledge on API fundamentals, including the business and technical cases for building and consuming web-based APIs.

COB4: To learn the requirements and implementation steps of the API Specification.

COB5: To expose on API security concerns.

MODULE I INTRODUCTION 9

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

MODULE II RESOURCES AND DESIGN PATTERNS 9

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

MODULE III CREATE AN API 9

Distributed Development -Modularizing Applications -Nonlinear Versioning - Communication -Empirical Programming- Method and Field Signatures-Files and Their Content-Environment Variables and Command-Line Options-Text Messages As APIs-Protocols-Behavior - Comprehensibility – Consistency-Discoverability - Life Cycle of an API

MODULE IV API DESIGN 9

A Method -A Factory Is Better Than a Constructor-Allow Access Only from Friend Code Removing a Method or a Field -Removing or Adding a Class or an Interface- Inserting an Interface or a Class into an Existing Hierarchy-Adding a Method or a Field - Types of Modular Design-Intercomponent Lookup and Communication.

MODULE V API SECURITY AND USER MANAGEMENT 9

User Management-Identification-Authentication-Usernames and Passwords- Session-Based Authentication-Other Authentication Methods-Fortify Authentication with SSL-Encryption-Threat Detection and Prevention-SQL Injection-XML and JSON Attacks-Data Masking-General Recommendations-API Data Protection Recommendations-API Security Recommendations

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Harihara Subramanian, Pethuru Raj, “Hands-On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure “RESTful web APIs”, Packt Publishing, 2019.

REFERENCES:

1. JJ Geewax, “API Design Patterns”, 1st Edition, Manning Publications, 2021.
2. Jason Paul Michel, ”Web Service APIs and Libraries”, ISBN= 978-0838911822, 2013.
3. Jaroslav Tulach, “Practical API Design: Confessions of a Java Framework Architect” ISBN=1430243171, 2012.
4. Daniel Jacobson , Greg Brail , Dan Woods, “APIs: A Strategy Guide”, ISBN=1449308929, 2011.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Use a suitable architecture for a given design problem

CO2:Analyze the types of resources and suitable design patterns for development and deployment.

CO3:Use API Design process to create API definitions

CO4:Create document for API processing and test APIs.

CO5: Implement security best practices for preventing security attacks

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1					M										
CO2					M				H						
CO3		H							M						
CO4					H										
CO5						H				H					

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement:Able to apply and explore learning strategies to define API resources, methods, parameters, and responses.

CSDX 132	**AAIP – ANIMATION WITH**	**L**	**T**	**P**	**C**
SDG: 9	**PORTFOLIO DEVELOPMENT**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the concepts of basic animation

COB2: To learn story telling skills to create, develop and execute animation sequences.

COB3: To familiarize with creative concepts and ideas to inanimate objects.

COB4: To expose on the techniques to create, capture animation sequences.

COB5: To explore industry standard tools and techniques of 3D Animation.

MODULE I INTRODUCTION 9

How animation works – Flipping, Flicking and Rolling – Bouncing ball in 2D and 3D–Principles of animation- How to design a 3D Character

MODULE II CONSTRUCTION OF A SIMPLECHARACTER, ITS ARTICULATIONAND BALANCE 9

Human anatomy-Joints-Moving in arcs-Planning a scene-Animating your characters

MODULE III ANIMATION OF INANIMATED OBJECTS 9

Inanimate Objects: Weight, Solidity,Force- Animation of Solids: Bowling Ball, Soccer Ball– Animation of Liquids: Drip, Splash – Animal walks.

MODULE IV ANIMATIONS AND REALISM 9

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

MODULE V TIMING, ANTICIPATION, OVERSHOOT, FOLLOW-THROUGH AND OVERLAPPING ACTION WITH AN ANIMATED CHARACTER 9

Timing – Anticipation - Follow through - Overlapping action - Vibration, MAYA Fundamentals - case studies

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Steve Roberts,"Character animation fundamentals: Developing skills for 2D and 3D character Animation‖, Elsevier Ltd, ISBN:9780240522272,2012.
2. Chris Webster,"Action Analysis for Animators", Focal Press; 1 edition,ISBN13: 978-0240812182,2012

REFERENCES:

1. Sheila Graber, "Animation A Handy Guide‖, A&C Black Published, firstedition, ISBN: 978140810283, 2009.
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, "Fundamental of ComputerGraphics‖, CRC Press, Fourth edition, ISBN: 9781498785907, 2015.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Create 3D characters and creatures ranging from life-like and anatomically correct, to cartoon and anime styles.

CO2: Integrate sophisticated technologies into 3D animated films, videos and games.

CO3: Incorporate 3D animated characters with composited backgrounds utilizing special effects.

CO4: Simulate sophisticated models for the entertainment, medical, and architectural industries.

CO5: Utilize a variety of digital applications including video and audio editing software and technologies.

Board of Studies (BoS) :

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Academic Council:

21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1														
CO2					L									M
CO3	H							M						
CO4													M	
CO5										H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Studying animation can provide opportunity to acquire expertise in a range of technical skills, including drawing and model-making which in turn can create huge employment opportunities.

CSDX 133	**MOBILE MULTIMEDIA SYSTEMS**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the basic concept of multimedia system.

COB2: To learn the various paradigms in mobile cellular networks.

COB3: To explore the security issues in multimedia system.

COB4: To expose the structure of the mobile networks using multiple input and output system.

COB5: To study the principles and trade-offs involved in the design of mobile networks.

MODULE I INTRODUCTION TO MOBILE MULITMEDIA 9

Where to use Mobile Multimedia – Multimedia over wireless Mobile data networks – Quality of Service issues – Speech and Video Coding.

MODULE II MOBILE CELLULAR SYSTEM 9

Narrowband cellular systems – Wideband systems: CDMA, OFDM, Multiuser capacity and opportunistic communication – MIMO I - MIMO II MIMO III and MIMO IV: multiuser communication.

MODULE III MULTIMEDIA SERVICES ON DIGITAL CELLULAR NETWORKS 9

Wireless multimedia using GSM Transport-Mobile Multiservice Data in TETRA PMR-Multimedia over Mobile Networks using the H.324 Family-Enabling Future Computer Applications using GSM Phones.

MODULE IV MOBILE TELECOMMUNICATIONS 9

Speech coding for Mobile Telecommunications- High-Quality Audio Coding for Mobile Multimedia Communications-A Narrowband Mobile Multimedia System.

MODULE V MOBILE SECURITY AND SERVICES 9

Security and privacy issues – Trust for mobile computing applications – Design challenges for Multimedia networks – QoS and QoE of cellular networks

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Gaur Karmakar, and Laurence S Dooley, “Mobile Multimedia Communications: Concepts, Applications, and Challenges”, IGI Global, 2008, ISBN: 9781591407683.
2. Yan Zhang, Shiwen Mao, Laurence T. Yang, and Thomas M Chen, “Broadband Mobile Multimedia: Techniques and Applications”, CRC Press, 2008. ISBN: 978-1-4200-5184-1.

REFERENCES:

1. Mobile Multimedia Processing: Fundamentals, Methods, and Applications. Germany, Springer, 2010.
2. David Tse and PramodViswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2010 ISBN:978-0-521-84527-4
3.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Develop, edit and improve interactive web pages that incorporate a variety of digital media such as graphics, voice, animation and video.

CO2: Create time-based and interactive multimedia components

CO3: Analyze and synthesize the key components of multimedia technologies including text, graphics, voice, video and animation.

CO4: Evaluate the role of multimedia technologies in the mobile environment.

CO5: Analyze the protocols, standards and representation techniques used for storage and transmission of multimedia information.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1					L								H	
CO2													H	L
CO3					L								H	
CO4													H	
CO5													h	L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Mobile is a key enabler of sustainable economic growth and a major contributor to the delivery of the Sustainable Development Goals (SDGs), a set of audacious targets to end poverty, halt climate change, and fight injustice and inequality.

CSDX 134	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the basic concepts of software project management.

COB2: To discuss various processes in software project management.

COB3: To expose various tools and packages.

COB4: To understand the nature of software development and software life cycle process models, agile project management and other agile practices.

COB5: To provide tools and techniques for project monitoring.

MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 9

Defining a project- Sequence of Activities – Complex Activities – A Business focused definition - Understanding the Scope Triangle - Managing the Creeps - Importance of Classifying Projects - Fundamentals of Project Management - Introducing Project Management Life Cycles - Choosing the Best - Fit PMLC Model.

MODULE II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model - Staffing Pattern.

MODULE III TPM PROJECT 9

Using Tools, Templates, and Processes to Plan a Project - Application Software Packages- Project Planning Tools – Planning and Conducting Joint Project - Building the WBS - Estimating - Constructing the Project Network Diagram - Effective Project Proposal - Launch a TPM Project- Monitor and Control a TPM Project.

MODULE IV COMPLEX PROJECT MANAGEMENT 9

Understanding the Complexity/Uncertainty - Traditional Project Management - Incremental Project Management Life Cycle - Agile Project Management - Iterative Project Management Life Cycle- Adaptive Project Management Life Cycle – Adapting and Integrating the APM Toolkit.

MODULE V BUILDING AN EFFECTIVE PROJECT MANAGEMENT **9**

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Robert K. Wysocki, —"Effective Project Management" – Traditional, Agile, Extremeǁ, 7th Edition, Wiley Publication, 2019.

REFERENCES:

1. Birgit Vogel-Heuser, Jan Keim, Lukas Märtin, Michael Goedicke, Ralf Reussner, Wilhelm Hasselbring— "Software Project Management in a Changing World",Springer International Publishing, 2019 (ISBN 13: 9783030134990, 3030134997)
2. Roger S. Pressman, —"Software Engineering", 8th edition, Mc Graw Hill Education, 2018.
3. https://www.google.co.in/books/edition/Software_Engineering/taIKxAEACAAJ?hl=en

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Explain the software project management concepts.

CO2: Acquire the ability to track project execution.

CO3: Estimate the cost and prepare project plan document.

CO4: Design a project management plan using different project management life cycles.

CO5: Lead a team and manage the people.

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Academic Council:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1					L								H	
CO2														
CO3		H						M						H
CO4														
CO5										H			H	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Software Project management course provides the complete procedure to develop the intended software product as per the industry execution methodologies in a specified period of time.

CSDX 135	ENTERPRISE RESOURCE PLANNING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To gain knowledge on the challenges of ERP in Business.

COB2: To understand the various ERP Products.

COB3: To expose the core process analysis activities.

COB4: To discuss issues relating to customization and testing

COB5: To learn the fundamentals of process modeling and ERP implementation

MODULE I INTRODUCTION 9

ERP as a Business Enabler– Evolution of ERP – ERP Life Cycle – ERP Products– Open-Source ERP- Project Initiation- Case Study

MODULE II CORE PROCESS ANALYSIS 9

Business Requirement Definition- Prerequisites- Activities- Deliverables– Decision Matrix – Conference Room Pilot– Business Flow Diagram- Install the CRP Instance.

MODULE III CORE PROCESS ANALYSIS 9

Process Flow Diagram, Gap Analysis, Design, Interface and Conversion, Implementation Schedule— Interface Development– Interface Integration Testing – Validate Backlog Transaction Data.

MODULE IV SYSTEM INTEGRATION TESTING AND TRAINING 9

Implementation Schedule—System and Regression Testing- Prepare Testing Environment – Task List for Training- Develop Training/User Procedures Strategy - End User Documentation.

MODULE V ERP IN BUSINESS SCHOOL 9

Operational Decision- Product Profitability Analysis- Management Reporting with ERP Systems - Project Management Life Cycle – Risk Management – Problem Management – Problem Reporting and Escalation- Methodology – Case Study

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Ganesh, K., Mohapatra, S., Anbuudayasankar, S.P. and Sivakumar, P., “Enterprise Resource Planning-Fundamentals of Design and

Implementation", Springer International Publishing, 1st Edition, ISBN: 978-3-319-05927-3, 2014

REFERENCES:

1. Ellen F. Monk and Bret J. Wagner, "Concepts In Enterprise Resource Planning", Course Technology, Cengage Learning, 4th Edition, ISBN: 978-1-111-82039-8, 2013.
2. LinekeSneller RC, "A Guide to ERP-benefits,implementation and trends", Bookboon Publication, 1st Edition, ISBN: 9788740307290, 2014.
3. Alexis Leon, Enterprise resource planning, 2nd Edition, McGraw Hill, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Define the terminology, features, and characteristics embodied in ERP

CO2: Apply the principles behind ERP to design real time applications.

CO3: Comprehend the analysis and activities of the business process chosen

CO4: Acquire practical competence in the usage and application of tools to support ERP in Business school

CO5: Compare the functioning of various ERP Implementations.

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Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		L									L		L	
CO2					H		L							
CO3			M	H										
CO4				M							L			M
CO5		L		M										

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Make basic use of Enterprise software, and its role in integrating business functions

The holistic understanding of the fundamentals of how ERP enables corporate organizations to experience multifaceted growth

CSDX 136	PROGRAMMING IN DATA SCIENCE	L	T	P	C
SDG: 4	WITH PYTHON	3	0	0	3

COURSE OBJECTIVES:

COB1:To learn the advanced Numerical Python features.

COB2: To expose the features of DataFrame for efficient storage and manipulation of labeled data in Python.

COB3: To explore data set from various sources.

COB4: To provide computational environments for data scientists using Python.

COB5: To know the capabilities of exploratory data analysis and data visualizations in Python.

MODULE I INTRODUCTION 8

Data Science – Data Science Methodology – Data Science Tasks - Python for Data Analysis – Essential Python Libraries – Ipython – Shortcuts – Ipython Magic Commands – Running External Code – In and Out Objects.

MODULE II NUMPY AND PANDAS 9

Numpy arrays – Computation – Universal Functions – Aggregations – Broadcasting – Comparisons – Masks – Boolean Logic – Fancy Indexing - Pandas Objects – Data Indexing and Selection – Data Operations - Handling Missing Data – Combining Data Sets – Concat - Append – Merge – Join.

MODULE III DATA PREPARATION 8

Data Set Retrieval – Data Preparation Phase – Adding Index Field – Changing Field Values – Categorical Data - Reexpression Standardizing Numerical Data – Identifying Outliers.

MODULE IV DATA MODELING 10

Data Partitioning – Validating Partition – Balancing Training Data Set – Classification and Regression Trees – Model Evaluation.

MODULE V EXPLORATORY DATA ANALYSIS 10

Scatter Plots – Line Plots - Bar Graphs – Contingency Tables – Histograms – Binning - Customizing Plots – Color bars - Text and Annotation – Real Time Applications – Case Study.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Chantal D.Larose, Daniel T.Larose, “Data Science using Python and R”, Wiley,1st Edition, ISBN: 9781119526810, 2019.
   Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O'Reilly Media, 1st Edition, ISBN: 9781491912058, 2016.

REFERENCES:

1. Jesus Rogel-Salazar, “Advanced Data Science and Analytics with Python”, CRC Press, 1st Edition, ISBN: 9780429822315, 2020.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ”, O'Reilly Media, 1st Edition , ISBN: B009NLMB8Q, 2012.
3. Joel Grus, “Data Science from Scratch: First Principles with Python”, O'Reilly Media, 1st Edition , ISBN: 9781491901427, 2015

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Use Python libraries for appropriate applications.

CO2: Apply data analysis tools in the pandas library.

CO3: Prepare the data for analysis.

CO4: Perform data modeling and validation.

CO5: Create scatter plots and static or interactive visualizations with matplotlib for real world problem solving.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	M	L	L	L	M	L	-	-	-	L	H	H	H
CO2	H	H	M	L	M	L	L	-	-	-	L	M	M	M
CO3	M	L	L	L	M	L	L	-	-	-	-	L	M	M
CO4	M	L	L	L	H	L	L	-	-	-	-	M	M	M
CO5	L	M	H	L	L	H	L	-	M	-	-	M	H	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4 : Quality Education - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

High-performance tools techniques are used to implement real world problems.

CSDX 137	GENETIC ALGORITHM	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To familiarize with Mathematical foundations for Genetic algorithm operators.

COB2: To study the Applications of Genetic Algorithms.

COB3: To understand filtering techniques and their broad applicability to a range of optimization problems.

COB4: To expose the importance of optimization in engineering activities.

COB5: To provide a broad introduction to the field of Genetic Algorithms and other fields of hierarchical genetic algorithm.

MODULE I INTRODUCTION 9

Chromosome Representation-Objective and Fitness Functions-Selection MethodsGenetic Operators-Intrinsic Characteristics-Parallel Genetic Algorithm-Multiple Objective-Robustness-Multimodel-constraints.

MODULE II FILTERING AND H-INFINITY CONTROL 9

Digital IIR Filter Design –Chromosome coding-The Lowest Filter Order Criterion - Time Delay Estimation-Active Noise Control-A Mixed Design Approach-The Distillation Column Design-Bench mark problem.

MODULE III HIERARCHICAL GENETIC ALGORITHM 9

Biological Inspiration-Hierarchical Chromosome Formulation-Genetic Operations Multiple Objective Approach-Neural Networks-Fuzzy Logic.

MODULE IV SPEECH RECOGNITION SYSTEMS 9

Back ground of Speech Recognition systems-Dynamic Time Warping-Genetic Time Warping algorithm-Cross over-Mutation-Hidden Markov model-A Multiprocessor system for parallel Genetic Algorithms.

MODULE V GENETIC ALGORITHMS IN PLANNING AND SCHEDULING PROBLEMS 9

ETPSPS scheme - Bottle neck analysis - selection key process -operational parameters for GA cycles - GA applications for ETPSP.

L – 45; TOTAL HOURS –45

TEXT BOOKS AND REFERENCES:

1. Kim-Fung Man, Kit Sang TANG, Sam Kwong,‖Genetic Algorithms: Concepts and Designs‖, Springer,4th Edition,ISBN:9781852330729,2012.
2. Michael Mutingi, Charles Mbohwa ,‖Grouping Genetic Algorithms: Advances and Applications‖,Springer,1st Edition ,ISBN:9783319443942,2017.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Explore the use of various GA operators In solving different types of GA problems.

CO2: Understand and expose the basic concepts of Genetic algorithms in communication systems.

CO3: Creating an understanding about the way the GA is used and the domain of application.

CO4: Formulate a problem as a hierarchical approach by specifying representations, selection and variation operators.

CO5: Apply genetic algorithms to planning and scheduling problems.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M		L				L							L
CO2		L			L					M		H		
CO3		M					H		M					M
CO4				L	H							L		L
CO5	M									H				

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Industry Innovation and Infrastructure

Statement: Promote inclusive and sustainable industrialization, Enhance research and upgrade the technology. streamlines a system by removing human inputs, which decreases errors, increases speed of delivery, boosts quality, minimizes costs, and simplifies the business process.

CSDX 138	**ADVANCED SAS: MACROS AND SQL**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the data manipulation using SAS.

COB2: To learn macro programs to reduce the complexity of SAS.

COB3: To explore macro variables and macro functions.

COB4: To expose the use of SQL and SAS in effective database management.

COB5: To gain knowledge of Macro programming with PROC SQL.

MODULE I DATA MANIPULATION AND THE SAS 9

Introduction to SAS- Reading Raw Data from External Files - Displaying Your Data- Using Advanced INPUT Techniques.

MODULE II SAS MACRO LANGUAGE 9

Introduction- Macro Variables-Local – Global-Built-In Macro Variables - LET Statement -Adding parameter to SAS Macros- Demonstrating a Simple Macro- Tokens -a Macro Variable as a Prefix –transfer of value between DATA Steps.

MODULE III SAS MACRO FUNCTIONS 9

SAS Macros Conditional and Iterative statement - %IF -% Then, macro character function – macro Evaluation Function - macro quoting function - Macro variable attribute function – other macro functions

MODULE IV SAS STRUCTURED QUERY LANGUAGE 9

Basics-PROC SQL STATEMENTS-Display Data Set -Creating Dataset from Existing Data -The WHERE Clause - Updating the Dataset - Deleting Rows from the Dataset, Joining Two dataset -Concatenating Data Sets - Summary Functions -an ORDER Clause -Fuzzy Matching.

MODULE V Macro Programming with PROC SQL 9

Row wise Data Update Including Security Check-Working with Multiple Files -: Transposing a SAS Table - Macros to Retrieve System Information - Creating Folders for Data Storage - Macro EXOTICS - Converting Entire Lists of String Variables to Numeric Variables

L –45; TOTAL HOURS –45

TEXT BOOKS:

1. Michele M. Burlew, SAS® Macro programming made easy, Third Edition. SAS Institute, Cary, NC, 2014.
2. Schendera, Christian FG. Advanced SQL with SAS. SAS Institute, 2020.

REFERENCES:

1. Carpenter, Art. Carpenter's complete Guide to the SAS Macro language. SAS Institute, 2016.
2. Alan C. Elliott, Wayne A. Woodward ”SAS Essentials: Mastering SAS for Data Analytics, 2nd Edition,ISBN: 978-1-119-04216-7,2015
3. https://support.sas.com/resources/papers/proceedings/proceedings/sugi30/257-30.pdf
4. https://data-flair.training/blogs/sas-sql/

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe data manipulation techniques using SAS.

CO2: Identify the usage of macro programming in SAS.

CO3: Implement various complex functionality with Micro functions.

CO4: Analyze the SQL functions used with SAS.

CO5: Apply the macro programming with SAS SQL.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M	M											L	
CO2		L	M				L							L
CO3						M	L							L
CO4	L				M									
CO5			L											M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans border infrastructure, to support economic

development and human well-being, with a focus on affordable and equitable access for all.

Statement: Students will be able to address problems in the real world using a variety of SAS tools and approaches in areas including business and economics.

CSDX 139	MICROSERVICES ARCHITECTURE	L	T	P	C
SDG: 9	(DevOps and Kubernetes)	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the fundamentals of Service Oriented Architecture.

COB2: To gain knowledge on application of Micro Services Architecture (MSA).

COB3: To learn the concepts of communication models.

COB4: To expose the information on DevOps, Dockers and Kubernetes.

COB5: To study building, designing, developing and deploying micro services.

MODULE I INTRODUCTION 9

CORBA, DCOM, RMI - Concept of Service Oriented Architecture (SOA) – Web services – Use cases of web services – Issues with web services - Need for Micro Services Architecture (MSA) – Issues with traditional enterprise applications – Capabilities, features and benefits of MSA – Drawbacks of MSA – MSA Vs SOA – Designing Microservices.

MODULE II APPLICABILITY OF MSA 9

Typical use cases of MSA – Amazon uses MSA & Cloud – Netflix uses MSA – Capital one uses MSA – Cloud based /Optimized Applications – E-service applications – Developing web applications – CPU/Intensive RAM parts of applications – Applications having multiple teams on same project – Cloud adoption .

MODULE III COMMUNICATION MODELS 9

Architectural element of micro services - Design principles of Micro services – Communication models for microservices – Synchronous communication: REST & HTTP - Asynchronous communication: Rabbit MQ Message Broker ,Apache Kafka message broker.

MODULE IV BUILDING INFRASTRUCURE PIPELINE 9

DevOps Principles and practices – Setting up IaC environment – Configuring Amazon Web services – Building an IaC pipeline – Building a Microservices infrastructure – Infrastructure components – Implementing the infrastructure – Dockers and Kubernetes installation.

MODULE V DEVELOPING AND RELEASING MICROSERVICES 9

Designing Microservice endpoints – Implementing data for a Microservice – Implementing code for a Microservice - Releasing Microservices – Setting up staging environment – Shipping the flight information container – Docker Hub – Kubernetes deployment .

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. ChellammalSurianarayanan, GopinathGanapathy," Essentials of Microservices Architecture", CRC Press, ISBN : 9781000627541, 1000627543,2019
2. Ronnie Mitra, Irakli ," Microservices: Up and Running" ,O'Reilly Media,ISBN : 9781492075424, 1492075426,2020.

REFERENCES:

1. KasunIndrasiri, PrabathSiriwardena ," Microservices for the Enterprise", Apress, ISBN: 9781484238585, 1484238583,2018.
2. Adam Bellemare ," Building Event-Driven Microservices", O'Reilly Media,ISBN: 9781492057840, 1492057843,2020.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Illustrate the importance of Micro Services Architecture (MSA) over SOA.

CO2: Analyze the applications of Micro Services Architecture (MSA).

CO3: Design microservices using communication models.

CO4: Build infrastructure pipeline through DevOps, Dockers and Kubernetes.

CO5: Develop and deploy microservices on setting up dockers and containers.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		L												
CO2			L										M	
CO3	M													
CO4					L									M
CO5				M										M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: By learning “Microservices Architecture”, the students are able to design build the infrastructure to implement the microservices through DevOps, Dockers and containers concept and deployment through Kubernetes which are the latest ongoing practices in industry thereby leads to the growth of innovation.

CSDX 140	ADVANCED GAME DESIGN	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand of game design and development

COB2: To study the processes, mechanics, issues in game design, game engine development

COB3: To learn the working phenomenon of OpenGL programming.

COB4: To explore the various Gaming tools and platforms.

COB5: To expose on the 2D and 3D interactive games using OpenGL.

MODULE I 3D GRAPHICS FOR GAME PROGRAMMING 9

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders.

MODULE II PARAMETRIC CURVES AND SURFACES 9

Bezier Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.

MODULE III GAME DESIGN PRINCIPLES 9

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding. Game Engine Design: Rendering, Controller based animation, collision detection, standard objects, and physics.

MODULE IV GAMING PLATFORMS AND FRAMEWORKS 9

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity.

MODULE V GAME DEVELOPMENT 9

Developing 2D and 3D interactive games using OpenGL, DirectX – Puzzle games, Single / Multi-player games.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Jeannie Novak, “Game Development Essentials”, 3rd Edition, Delmar Cengage Learning, ISBN-13: 978-1111307653, 2011.

REFERENCES:

1. Jim Thompson, Barnaby Berbank-Green, and NicCusworth, “Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer”, 1st edition, Wiley, ISBN 0471968943, 2007
2. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” , Morgan Kaufmann, 2 Edition, ISBN-13: 978-0122290633, 2006

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Apply 3 D concepts in Game programming.

CO2: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.

CO3: Communicate effectively in a variety of professional contexts.

CO4: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

CO5: Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.

CO6: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H				L									H
CO2													H	
CO3		H						M						
CO4				L										
CO5										H				L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Industry Innovation and Infrastructure

Statement: Promote inclusive and sustainable industrialization, Enhance research and upgrade the technology. Streamlines a system by removing human inputs, increases speed of delivery, boosts quality, minimizes costs, and simplifies the business process.

CSDX 141	DOCKERS AND CONTAINERS	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To explore the overview of Dockers and Containers

COB2: To provide various opportunities of Docker file

COB3: To expose the risks present in Dockers and containers

COB4: To focus on security issues with commonly used Docker architecture

COB5: To understand the policy and privacy frame work that addresses the Dockers & containers

MODULE I INTRODUCTION TO DOCKERS 9

Dockers – Docker Architecture – Difference between Dockers &VM,s – Merits & Demerits of Dockers– Docker use cases – Docker limitations.

MODULE II DOCKER ARCHITECTURE 9

Docker LXC – CGROUP – Union File system (AUFS) – Controlled OS Resources – Docker Kernel Namespaces – Docker images

MODULE III DOCKERS REPOSITORIES 9

Docker Repositories – Docker Containers – Building image from Docker – Docker as daemon – Docker registry & hub – Merits & Demerits of Dockers Architecture.

MODULE IV IMAGES & CONTAINERS 9

Containers – Images – Docker container lifecycle – container lifecycle – Difference between image & Dockers – Container Volumes – using Docker hub registry – Building images.

MODULE V DOCKERS & KUBERNETES 9

Deploy Docker containers with K8S – Difference between Dockers & Kubernetes – Docker compose – Services and multiple containers –Yml syntax of Dockers

L– 45; TOTAL HOURS – 45

TEXT BOOKS:

1. James, Turnbull,The Docker Book, , 2014,“Docker and Kubernetes, Docker Community publishers ,1st edition, 2014.

2. Jeff Nicoloff, Docker In Action, “Docker for the Absolute Beginners – hands-on DevOps, , 2nd Edition 2015.

REFERENCES:

1. Farhan HasinChowdary, The Docker Handbook –Learn Docker for beginners, Dockers Community publishers , 2021.
2. Jeff Nicoloff,StepenKuenzli,”Docker in action”,Manning Publishers, 2nd edition,2019

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: functions of various Dockers & Containers sites.

CO2: Identify the usage of Dockers & Containers in the public sectors.

CO3: Acquire knowledge on uses of Dockers & Containers

CO4: Analyze the working of Dockers & Containers and to take preventive measures

CO5: Explore the policies and privacy framework of various Dockers & Containers

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M	M	M	L	L	L			L	L	L		L	
CO2	M	M	M	L	L	L			L	L	L		L	L
CO3	M	M	M	L	L				L	L	L		L	L
CO4	M	M	M	M	H	L			M	L	L		L	
CO5	M	L	L	M	L				M	L	L		L	

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

CSDX 142	AI CHAT BOT APPLICATION	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the dialogue systems with its different types and architecture.

COB2: To address the concept of conversational UI and show how they evolved and their challenges.

COB3: To explore the Chatbots considering the business need using tools like Dialog flow**.**

COB4:to learn the methods when NLP is needed for Chatbots.

COB5: To expose the challenges and areas of further development in dialogue systems for problem solving.

MODULE I DIALOGUE SYSTEM 9

Dialogue System – History – Present Day Dialogue Systems – Modelling Conversation in Dialogue System – Dialogue System Architecture – Designing Dialogue System - Tools.

MODULE II CONVERSATIONAL UI 9

Conversational UI – Evolution – Stack of Conversational UI – Challenges – Gaps – Sources of Data – Chatbot Conversations – Training Chatbots – Chatbot Development Approaches.

MODULE III BUILDING CHATBOT 9

Need for Chatbots - Business Considerations– Starting with Chatbots – Decision Tree - Chatbot Frameworks – Components of Chatbot -– Building Conversational App - Dialogflow.

MODULE IV NLP FOR CHATBOTS 9

Methods of NLP for building Chatbot – Things in NLP for Chatbot – spaCy Models –Designing Messenger Chatbot – Integrating Chatbot on Messenger – Deploying Chatbot

MODULE V FUTURE DIRECTIONS 9

Multimodality in Dialogue – Reasoning and Problem Solving in Dialogue Systems- Dialogue with Social Robots – Dialogue and IoT -Social and Ethical Issues.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Michael Mc Tear, “Conversational AI Dialogue Systems, Conversational Agents, and Chatbots”, Morgan and Claypool Publishers, 2021, ISBN:9781636390321

REFERENCES:

1. Rachel Batish, “Voicebot and Chatbot Design”, Packt Publishers, 2018, ISBN:9781789136883.
2. Sumit Raj, “Building Chatbots with Python- Using Natural Language Processing and Machine Learning”, Apress Publishers, 2019. ISBN:9781484240960.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Design an AI assistant that helps in achieving the goals and satisfying the user.

CO2: Outline what an conversational AI is and analyze the gaps in training chatbots.

CO3: Describe things related to chatbots from both business and developers perspective.

CO4: Identify the tools and methods to use when NLP is needed for chatbots.

CO5: Explore the various challenges and ethical issues in designing chatbots for various applications.

Board of Studies (BoS) : 22nd BoS of CSE held on 17.08.2023

Academic Council: 21st AC held on 20.12.2023

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M	H	H										H	
CO2		H		M									H	
CO3													L	
CO4				H										M
CO5								H		L				H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Understands the local, national and global challenges and conflicts in achieving sustainability in infrastructure and industrialization.

PHYSICS ELECTIVE

		L	T	P	C
PHDX 01	**NON DESTRUCTIVE TESTING OF MATERIALS**				
SDG: 4		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1:To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

COB2:To study the working and instrumentation of thermography and eddy current testing methods and apply to interpret the results and investigate the possible defects.

COB3:To get full exposure about principle, instrumentation and standards of various radiographic NDT methods and improve the skill to identify the defects suitably.

COB4:To get deep insight into the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT methods.

COB5:To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

MODULE I SURFACE NDT METHODS 7

Liquid Penetrant Inspection – Principles, Types of dye and methods of application,developers, advantages and limitations of various methods, Interpretation of results. Magnetic Particle Inspection- Magnetic particle testing, Basic theory of magnetism, Magnetization methods, Interpretation of field indicators, Particle application, Inspection,Residual magnetism Principles and methods of demagnetization.

MODULE II THERMOGRAPHY AND EDDY CURRENT TESTING 7

Thermography- Principles, Contact and non contact inspection methods, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Applications, advantages, Limitations, Interpretation/Evaluation.

MODULE III RADIOGRAPHY 8

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse

square law, characteristics of films -graininess, density, speed, contrast, characteristic curves. Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography.

MODULE IV ULTRASONIC TESTING 8

Ultrasonic Testing: Basic principles of sound propagation, types of sound waves, Principle of UT, methods of UT, their advantages and limitations, Piezoelectric Material, Various types of transducers/probe, Calibration methods, use of standard blocks, technique for normal beam inspection.

L – 30;Total Hours –30

TEXT BOOKS:

1. ASM Metals Handbook,Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, 200, 2018.
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu Practical Non-Destructive Testing, Narosa Publishing House, 2014.

REFERENCES:

1. Ravi Prakash, Non-Destructive Testing Techniques, 1st revised edition, New Age International Publishers, 2010.
2. Paul E Mix, Introduction to Non-destructive testing: a training guide, Wiley, 2nd Edition New Jersey, 2005.
3. Charles, J. Hellier, Handbook of Nondestructive evaluation, McGraw Hill, New York 2001.
4. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).

COURSE OUTCOMES:

CO1: Demonstrate the importance, principle, concept and inspection methods of various surface NDT methods and apply the same to interpret the results effectively.

CO2:Comprehend the ideas behind working of thermography and eddy current testing methods and apply them to interpret the results of testing and analyse the defects and problem.

CO3:Grasp the fundamental principles and standards of various radiographic NDT methods and utilise them to identify the defects and defect location suitably.

CO4: Assimilate the ideas concerning the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT

methods and identify the areas for their application.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 02	MATERIALS SCIENCE FOR ENGINEERING	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1: To impart knowledge on the fundamentals of materials science and engineering.

COB2: To provide a basis for understanding properties and applications of dielectric materials.

COB3: To expose the students to different classes of materials, their properties, structures and imperfections

COB4:To aid the teaching learning process through relevant illustrations, animations, web content and practical examples

MODULE I CLASSIFICATION OF MATERIALS 6

Concept of amorphous, single crystals and polycrystalline materials, crystallinity and its effect on physical properties, metal, ceramic, polymers, classification of polymers, structure and properties, additives for polymer products, effect of environment on materials, composites

MODULE II PROPERTIES OF MATERIALS 10

Mechanical Properties: Stress-strain response of metallic, ceramic and polymer materials, yield strength, tensile strength and modulus of elasticity, toughness, plastic deformation, fatigue, creep and fracture- Electronic Properties:Free electron theory, Fermi energy, density of states, band theory of solids, semiconductors, Hall effect, dielectric behaviour, piezo, ferro, pyroelectric materials - Magnetic Properties: Origin of magnetism in metallic and ceramic materials, para-magnetism, diamagnetism, ferro and ferrimagnetism- Thermal Properties: Specific heat, thermal conductivity and thermal expansion, thermoelectricity- Optical Properties: Refractive index, absorption and transmission of electromagnetic radiation in solids, electro-optic and magneto-optic materials.

MODULE III CRYSTALLOGRAPHIC STRUCTURES AND IMPERFECTIONS 7

Crystal symmetry, point groups, space groups, indices of planes, close packing in solids, bonding in materials, coordination and radius ratio concepts, point defects, dislocations, grain boundaries, surface energy and equilibrium shapes of crystals.

MODULE IV THERMODYNAMICS AND KINETICS 7

Phase rule, phase diagrams, solid solutions, invariant reactions, lever rule, basic heat treatment of metals, solidification and phase transformations, Fick's laws of diffusion, mechanisms of diffusion, temperature dependence of diffusivity.

L – 30; Total Hours –30

TEXT BOOKS:

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

REFERENCES:

1. William D. Callister, Jr., David G. Rethwisch, Materials Science and Engineering, Edition 9, Wiley, 2014.
2. Michael F. Ashby, David R.H. Jones , Engineering Materials 1 An Introduction to Properties, Applications and Design · Volume 1, Elsevier Science, 2012
3. Michael F. Ashby, David R.H. Jones , Engineering Materials 2: An Introduction to Microstructures, Processing and Design · Volume 2, Elsevier Science, 2013
4. Reza Abbaschian, Robert E. Reed-Hill, Physical Metallurgy Principles - SI Version, Cengage Learning, NY, 2009
5. "Encyclopedia of Polymer Science and Technology" 3rd Edition, Vol.1-12, Wiley Interscience , 2003

COURSE OUTCOMES

At the end of the course, students will be able to

CO1:select suitable material for specific application.

CO2: analyse crystallographic structure of metals and their imperfections.

CO3: develop metal alloys with varying properties by selecting suitable heat treatment

CO4: correlate the various properties of material with their structure.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 03	BIOMATERIALS	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1:To gain basic knowledge in classification of biomaterials and their properties.

COB2:To provide a basis for understanding properties of metallic implant materials.

COB3:To enable the students to correlate theoretical principles with practical applications.

COB4:To help students understand biocompatibility & toxicological screening of biomaterials

MODULE I INTRODUCTION TO BIOMATERIALS 8

Introduction: Definition of biomaterials, requirements & classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Surface properties of materials, physical properties of materials, mechanical properties-Materials for biophotonic applications.

MODULE II IMPLANT MATERIALS 10

Metallic implants: Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion-ceramic implants : bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics-Polymer implants: Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin.

MODULE III BIOCOMPATIBILITY AND TOXICOLOGICAL SCREENING OF BIOMATERIALS 6

Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ-implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

MODULE IV PRACTICAL ASPECTS OF BIOMATERIALS 6

Preparation of biomaterials - Microscopic study & analysis of different biomaterials- alginate – material preparation and characterization - Testing of various biomaterials- case studies on industrial and clinical applications of biomaterials.

L – 30; Total Hours –30

TEXT BOOKS:

1. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill, 2003
2. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and KratiJain. Implant biomaterials: A comprehensive review, World Journal of Clinical Cases, 2015.

REFERENCES:

1. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, Introduction to Biomedical Engineering, Elsevier, 2005.
2. Park J.B., Biomaterials Science and Engineering, Plenum Press, 2007.
3. A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran,Woodhead Medical Textiles and Biomaterials for Healthcare, Publishing Limited 2006.
4. D F Williams, Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume, VCH Publishers 1992.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: differentiate common use of biomaterials as metals, ceramics, polymers and apply them to classify its chemical structure, properties and morphology.

CO2: comprehend ideas involving general properties of implant materials and apply the same to identify the benefits of implant materials.

CO3: attain knowledge about the biocompatibility & toxicological screening of biomaterials and realize its usage in real life.

CO4: reflect upon the practical ideas of using biomaterials

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	M	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	L	L	M	M	M	L	L	L	M	-	-	-
CO3	M	L	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	M	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 04	OPTICAL FIBRE COMMUNICATION	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1:To facilitate the knowledge about optical fibres and its transmission characteristics.

COB2:To make the students to learn about LED and laser diodes.

COB3:To make the students understand the various types of opticalreceiversand sensors.

COB4:To enrich the knowledge on optical amplifiers and networks.

MODULE I INTRODUCTION TO OPTICAL FIBRES 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers.

MODULE II FIBER OPTICAL SOURCES 7

Light Emitting Diodes (LED) – power and efficiency - double hetero LED – LED structure - LED characteristics – Semiconductor Lasers diode, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers - applications.

MODULE III FIBER OPTICAL RECEIVERS AND SENSORS 8

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film solar cells, amorphous silicon solar cells - Fiber optic sensors: Intrinsic and Extrinsic sensors, amplitude, phase, wavelength and polarization modulation.

MODULE IV OPTICAL AMPLIFIERS AND NETWORKS 8

Optical amplifiers, Semiconductor optical amplifiers, Erbium-doped fiber amplifiers - Optical Networks: Basic networks, SONET/SDH, WDM Networks, Nonlinear effects on network performance, Performance of WDM + EDFA systems, Solitons, Optical CDMA, Ultrahigh capacity networks.

L – 30; Total Hours –30

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communication, 3rd Edition, McGraw-Hill International, Singapore, 2013.

REFERENCES:

1. Govind P. Agrawal, Fiber-Optic Communication Systems (Wiley Series in Microwave and Optical Engineering) , Wiley 4th Edition, 2010.
2. J. Senior, Optical Communication, Principles and Practice, Prentice Hall of India, 3rd Edition, 2010.
3. D. C. Agrawal, Fiber Optic Communication, S.Chand& Co Ltd., 2005.
4. Rajiv Ramaswami, KumarSivarajan, Galen Sasaki, Optical Networks: A Practical Perspective, 3rd Edition, Morgan Kaufmann, 2009.
5. B. Culshaw, Optical Fiber Sensing and Signal Processing, Peter Peregrinus Ltd, 2014.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1:realize basics of optical fiber and differentiate various modes andconfigurations.

CO2:understand and assimilate the working principle of LED andDiode Laser.

CO3:select suitable photodetectors/sensorsfor different types of applications.

CO4:analyze the mechanism of optical amplifiers and analyze opticalnetworks.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 05	SEMICONDUCTOR PHYSICS FOR	L	T	P	C
SDG: 4	INFORMATION TECHNOLOGY	2	0	0	2

COURSE OBJECTIVES:

COB1:To understand the physics of semiconductor devices

COB2:To gain knowledge on various methods involved in nanofabrication of semiconductor devices

COB2:To study the working principle of optoelectronic devices andvarious display devices

COB4:To get insight to different types of data storage technologies

MODULE I INTRODUCTION TO SEMICONDUCTOR DEVICES 6

Semiconductors: N and P type, PN junction diode under forward and reverse bias —- Zener diode, Schottky diode – Tunnel diode –bipolar junction transistor (BJT) - metal–oxide–semiconductor field-effect transistor (MOSFET), CMOS-concepts and fabrication.

MODULE II FABRICATION OF SEMICONDUCTOR DEVICES 6

Deposition of Semiconductor thin films – molecular beam epitaxy (MBE), chemical vapour deposition (CVD), pulsed laser deposition (PLD),magnetron sputtering,Types of lithography:Photo/ultraviolet /Electron-beam/Focused ion beam, Dip pen nanolithography, Etching process :Dry and Wet etching

MODULE III OPTOELECTRONIC DEVICES 10

Light Emitting Diodes (LED) - double hetero LED structure - LED characteristics - White LED – Applications, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical detection – PIN and avalanche photodiodes, Applications: Optical mouse, traffic lights, Luminescence, Cathode Luminescence, Electro Luminescence, Transparent Conductors, Liquid crystal displays – Dynamic scattering and Twisted nematic display, Display Glasses, Organic LEDs display, Charge-coupled devices (CCD), Inorganic Semiconductor TFT Technology, Organic TFT Technology; Flexible Displays, Touch Screen Technology.

MODULE IV MEMORY STORAGE DEVICES 8

Introduction to memory storage, Resistive Random Access Memory (ReRAM), Phase Change Memory (PCM); Magnetoresistive Random Access Memory (MRAM)- Gaint Magnetoresistance (GMR), Tunnel Magnetoresistance (TMR),

Ferroelectric Random Access Memory (FeRAM); Comparison and future directions, Hardware circuits, working analysis.

L – 30;Total Hours –30

TEXT BOOKS:

1. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate(Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2. Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3. D. S. Dhaliwal et al., Prevail :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.

REFERENCES:

1. V.K. Mehta, Rohit Mehta, Principles of Electronics (Multicolour Edition) S. Chand Publishers, 10th Rev. Edn. 2006 Edition
2. Albert Malvino, David J. Bates Electronic Principles (SIE), McGraw Hill, 7th Edition, 2017
3. U. Mishra, J. Singh, Semiconductor Device Physics and Design, Springer, 2014
4. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley Publishers, 3ed 2008.
5. Bhattacharya Pallab, Semiconductor Optoelectronic Devices, Second Edition, By Pearson 2017
6. Joseph A. Castellano, Handbook of Display Technology, Springer, 1992
7. Yoshio Nishi, Advances in Non-volatile Memory and Storage Technology, Elsevier 2014

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1:understand the physics of semiconductor devices and identify its significance towards information technology (IT).

CO1: gain insight into various fabrication techniques towards therealization of nano-dimensional semiconductor devices.

CO2: attain knowledge on working principles of optoelectronic devices and display technologies and can recognize their importance in commercial applications.

CO4: learn the principle of data storage and its application towards futuristic memory technology.

Board of Studies (BoS) : **Academic Council:**

BOS of Physics was held on 21.6.21 17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 06	SENSORS AND ACTUATORS	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1: To understand the basic concept of sensors towards detection of pressure, position, velocity and temperature.

COB2: To avail knowledge on sensor which are sensitive to light, magnetic field, and acoustic waves

COB3: To study the different types of fabrication techniques towards realization of various sensors.

COB4: To get introduced towards MEMS technology and various actuators.

MODULE I INTRODUCTION TO SENSORS: PRESSURE, POSITION, VELOCITY AND TEMPERATURE 8

Introduction to sensors – working principles– classification – static and dynamic characteristics, Error Analysis, Pressure sensors – strain gauge, piezoelectric force sensor, vacuum sensors, Position sensor -Proximity sensor, Capacitive, Inductive and displacement sensor, velocity and acceleration sensors, Temperature sensor-thermocouples- thermistors-Thermo-EMF Sensors, metal Junction and metal Semiconductor junction types.

MODULE II SENSORS : LIGHT, MAGNETIC FIELD AND ACOUSTIC 8

Photocondutors- Optical Detectors - Photodiodes, Phototranistors, Optical encoder-Charge Coupled Device (CCD), Fabry Perot sensor, Hall effect, magneto resistive, magneto strictive sensors, Acoustic sensors-microphones-resistive, capacitive, piezoelectric, fiber optic, solid state - electrect microphone.

MODULE III SENSORS FABRICATION TECHNIQUES 7

Fabrication techniques – molecular beam epitaxy (MBE), chemical vapour deposition (CVD), pulsed laser deposition (PLD),magnetron sputtering,Types of lithography:Photo/ultraviolet /Electron-beam/Focused ion beam, Dip pen nanolithography, Etching process :Dry and Wet etching

MODULE IV MICROSYSTEMS AND ACTUATORS 7

Microelectro-mechanical systems (MEMS) - RF- MEMS, Micro fabrication and Applications, Classification of transducers: electrostatic, piezoelectric, thermal, Microsystem design and fabrication.working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications Solid-state switches, relays Solenoids, D.C. Motors, A.C. Motors, Stepper motors. Shape memory alloy actuators.

L – 30;Total Hours –30

TEXT BOOKS:

1. Jacob Fraden, Hand Book of Modern Sensors: physics, Designs and Applications, 3rd edition, Springer, New York, 2015.
2. Jon. S. Wilson, Sensor Technology Hand Book, 1st edition, Elsevier, Netherland, 2011.
3. John G Webster, Measurement, Instrumentation and sensor Handbook, 2nd edition, CRC Press, Florida, 2014.

REFERENCES:

1. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate (Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2. Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3. D. S. Dhaliwal et al., PREVAIL :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.
4. Tai-Ran Hsu, MEMS & Microsystem, Design and Manufacture, 1st ed., McGraw Hill India, New Delhi, 2017.
5. MassoodTabibArar, Microactuators – Electrical, Magnetic Thermal, Optical, Mechanical, Chemical and Smart structures, 1st ed., Kluwer Academic publishers, New York, 2014.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: get exposed to various types of sensors and apply the ideas to distinguish between pressure, position, velocity and temperature based sensors

CO2: familiarize towards light, magnetic field, and acoustic based sensors and recognize their importance in commercial applications.

CO3: gain insight into various fabrication techniques towards the realization of sensors

CO4:apply the ideas to conceptualize MEMS technology and different actuators in engineering field

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	M	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	L	L	M	M	M	L	L	L	M	-	-	-
CO3	M	L	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	M	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

PHDX 07	FUNDAMENTALS OF NANOTECHNOLOGY AND ITS APPLICATIONS	L	T	P	C
		2	0	0	2

SDG: 4

COURSE OBJECTIVES:

COB1:To introduce the basic concepts of Nanoscience through quantum mechanical theories and solid state physics.

COB2: To provide knowledge about the various synthesis methods applicable to different nano materials

COB3: To enrich the knowledge of students in various characterisation techniques.

COB4:To provide knowledge on applications of poymer based nano materials in various fields.

MODULE I BASICS OF NANO SCIENCE 7

Introduction to Nanoscience &Nanotechnology : Review of classical mechanics – overview Quantum Mechanics. Background to nanoscience and nanotechnology - scientific revolutions - nanosized effects – surface to volume ratio – atomic structure – molecular and atomic size - quantum effects - formation of nano sized particles – energy at the nanoscale.

MODULE II SYNTHESIS OF NANOMATERIALS 8

Nanomaterial Fabrication: Bottom-up vs. top-down - Preparations of Nanomaterials by mechanical and physical methods : – High energy ball milling – melt quenching and annealing – vapour deposition – Pulsed laser deposition – Magnetron sputtering - Microwave plasma evaporation. Chemical Methods of Preparation : Sol-gel method –Electrodeposition – Electrospinning. Arc method for carbon nanotubes – nanofibres and rods – synthesis of Graphene- Handling of nano particles - Health hazards – Precautions.

MODULE III CHARACTERIZATION OF NANOMATERIALS 8

Characterisation of Nanomaterials: XRD – particle size determination - SEM - FESEM - TEM – AFM – Nanoindentor – UV-VIS spectroscopy – FTIR, FT-Raman, Photoluminescence, NMR, ESR - Dielectric characterization – Magnetic characterization.

MODULE IV APPLICATION OF NANO MATERIALS 7

Applications of Carbon based nanomaterials (CNT, CNF, Graphene) - Biosensor (principle, component, types, applications) - agriculture (nano-fertilizers, herbicides, nano-seed science, nano-pesticides) and food Systems

(encapsulation of functional foods, nano-packaging) – Nano - electronics, Nano-optics.

L – 30; Total Hours –30

TEXT BOOKS:

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

REFERENCES:

1. Nanotechnology: basic science and emerging technologies by Mick Wilson, Kamali Kannangara, Geoff Smith, and Michelle Simmons, Chapman & Hall/CRC; I edition, 2002.
2. Handbook of NanoScience, Engineering and Technology by Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., CRC Press, 2012.
3. Nanocomposite Science and Technology by P. M. Ajayan, L. S. Schadler, P. V. Braun, WILEY-VCH Verlag GmbH, 2003.
4. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

COURSE OUTCOMES:

At the end of the course, students will be able to

CO1: understand basic principles of nanomaterials and apply them todifferentiate the significance of nanomaterials compared to bulk materials.

CO2: familiarize the various synthesis methods of nanomaterials andcompare them with the preparation of materials in bulk form.

CO3: get useful ideas about characterization techniques and differentiatedifferent techniques.

CO4: understand the various applications of nanomaterilas and realize the role of nanomaterials in various fields

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
CO1	L	L	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	H	L	M	H	M	L	L	L	M	-	-	-
CO3	L	M	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	H	L	M	L	M	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and promote learning opportunities at all times.

CHEMISTRY ELECTIVE

CHDX 01	**CHEMISTRY OF CONSTRUCTION MATERIALS**	**L**	**T**	**P**	**C**
SDG: 9		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

To impart knowledge on

COB1: the chemistry of cement and concrete

COB2: the properties of steel and mechanism of corrosion

COB3:the quality of water and its impact on concrete

COB4: the analytical techniques for concrete research

MODULE I CHEMISTRY OF CEMENT AND CONCRETE 8

Cement - chemical composition - Bogue's compounds - hydration of cement - hydrated products - influence of hydrated products on properties of cement - types of cement - microstructure of aggregate phase and hydrated cement paste - Interfacial transition zone in concrete: significance and microstructure

MODULE II CHEMISTRY OF STEEL AND CORROSION 8

Steel for construction - chemical composition - types of steels - influence of chemical composition on properties. Corrosion of steel - mechanism of corrosion of steel in water and concrete medium - types of corrosion of steel associated to civil engineering. Corrosion prevention and control: coatings & inhibitors - working mechanism. Cathodic protection to steel: Concept - working mechanism - sacrificial anodes

MODULE III WATER CHEMISTRY FOR CONCRETE 7

Water quality parameters – pH, solids, hardness, alkalinity,chloride and sulphates in water and their determination- Water quality for building construction – Effect of water impurities on concrete strength and durability- Carbonate and Sulphate attack-Chloride attack –Alkali-Silica reactions in concrete-Case studies

MODULE IV ANALYTICAL TECHNIQUES FOR CONCRETE RESEARCH 7

Analytical techniques for cement concrete research - FITR spectroscopy - SEM - XRD - Cyclic voltammetry (CV) - Thermo-gravimetric analysis (TGA) and Differential thermal analysis (DTA) - Advanced chloride and water analysis techniques.

L – 30; Total Hours –30

TEXT BOOKS:

1. Wieslaw Kurdowski, Cement and Concrete Chemistry, Springer Netherlands, 2014.

REFERENCES:

1. P.C Jain and Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd.,New Delhi , 2013.
2. S SUmare and S S Dara, A text Book of Engineering Chemistry, S. Chand and Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company,NewYork, 1984.
4. B. Sivasnakar, Engineering Chemistry, Tata McGrow - Hill Publication Limited, New Delhi,second reprint 2008.
5. P. Kumar Mehta and Paulo J.M. Moteiro, "Concrete : Microstructure, Properties and Materials", McGraw Hill Education (India) Pvt. Ltd., 4th Edition, New Delhi, 2014
6. APHA Standard Methods for the Examination of Water & Wastewater, American Public Health Association, USA, 2005.

COURSE OUTCOMES:

CO1: Explain the properties of cement and concrete

CO2:Describe the properties of steel, mechanism of corrosion and its prevention

CO3: Enumerate the impact of water quality on the concrete

CO4:Elaborate the principle, instrumentation and applications of various analytical techniques for concrete research

Board of Studies (BoS) :
11thBoS of Chemistry held on 17.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	L	-	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	M	-	-	-	-	-	-	-	-	M	-	-
CO3	-	-	-	-	-	-	M	-	-	-	-	-	L	-	-
CO4	-	-	-	M	-	-	-	-	-	-	-	-	L	-	-

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

CHDX 02	CHEMISTRY OF MATERIALS AND ELECTROCHEMICAL DEVICES	L	T	P	C
SDG: 9		2	0	0	2

COURSE OBJECTIVES:

The students will be conversant with

COB1:concepts of corrosion, types and various methods to control corrosion.

COB2:the chemicals, chemical reactions, construction and working of different batteries and fuels cells.

COB3:the types, properties and manufacture of refractories and abrasives.

COB4:types, functions of lubricants and mechanism of lubrication.

MODULE I CORROSION AND ITS CONTROL 8

Types of corrosion - chemical corrosion – electrochemical corrosion – galvanic corrosion – differential aeration corrosion - factors influencing rate of corrosion. Corrosion control – selection of materials - cathodic protection: sacrificial anode - corrosion inhibitors – paints: constituents & functions – treatment of metal surface for inorganic coatings - metallic coatings: hot dipping: galvanizing and tinning – electroplating — electroless plating.

MODULE II ELECTROCHEMICAL DEVICES 8

Electrochemical cell, electrolytic cell - introduction to batteries – classification – primary: dry alkaline – secondary: lead–acid, nickel–cadmium and lithium batteries, Fuel cells – classification based on temperature and electrolyte - hydrogen–oxygen fuel cell, applications – solar cells: construction and working – dye sensitised solar cells.

MODULE III REFRACTORIES AND ABRASIVES 7

Refractories: Introduction - refractory - classification – based on chemical nature - characteristic and selection of good refractory - properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability – general manufacture of refractory – components, properties and uses of: silica, magnesite, zirconia refractories - super refractories - application of refractories.

Abrasives: classification - Moh’s scale – properties - natural abrasives: diamond, corundum, emery, garnet, quartz - synthetic abrasives: preparation, properties and uses: carborundum, alundum, boron carbide (norbide), tungsten carbide, zirconium silicate – grinding wheel – abrasive paper and cloth - Rockwell scale test - knoop hardness test.

MODULE IV LUBRICANTS 7

Introduction – functions of lubricant- mechanism of lubrication - classification of lubricant – selection of lubricants - lubricating oils - properties of lubricant: viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue - semisolid: grease (sodium, calcium, lithium, aluminium) - solid lubricant: graphite, graphene, molybdenum disulphide – lubricating emulsions - cutting fluids – synthetic and semi-synthetic lubricants.

L – 30;Total Hours – 30

TEXT BOOKS:

1. Jain P.C and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Co., New Delhi. 2016.

REFERENCES:

1. E. McCafferty, “Introduction to Corrosion Science” Springer, May 2010.
2. Tulika Sharma “Electrochemical devices” LAP Lambert Academic Publishing, 2011.
3. Jeffry S Gaffney, Nancy A Marley General chemistry for engineers, Elsevier, 2018.
4. Don M Pirro, Martin Webster, Ekkehard Daschner “Lubrication Fundamentals”, Taylor & Francis Gp,LLC, 2016.
5. Theo Mang, Wilfred Dresel “Lubricants and Lubrication” Wiley-VCH, 2017

COURSE OUTCOMES:

The students will be able to

CO1:apply specific methods to control corrosion of different materials.

CO2: illustrate the construction and working of different types of cells, batteries and fuel cells.

CO3: compare the properties and devise a method of manufacture of refractories and abrasives.

CO4: analyze and choose the right type of lubrication based on the type of machines.

Board of Studies (BoS) : 11thBoS of Chemistry held on 17.06.2021

Academic Council: 17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	L	-	-	-	-	M	-	M	-
CO2	H	-	-	-	-	-	M	-	-	-	-	L	-	M	-
CO3	M	-	-	-	-	-	-	-	-	-	-	-	-	L	-
CO4	H	-	-	-	-	-	L	-	-	-	-	L	-	M	-

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CHDX 03	**CHEMISTRY AND INSTRUMENTATION**	**L**	**T**	**P**	**C**
SDG: 9	**FOR ELECTRICAL AND ELECTRONIC APPLICATIONS**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: Synthesis, properties and applications of electrical and electronic devices.

COB2: Classification and types of fuel cells.

COB3: Types of sensors and their applications.

COB4: Principle, instrumentation and applications of analytical techniques.

MODULE I ELECTRICAL AND ELECTRONIC DEVICES 7

Solar Cell- Si solar cell, quantum dot solar cell, LCD : components, liquid crystals and their composition, electrodes – OLEDS: components, synthesis and modification of small molecules, polymers, phosphors - FRP-synthesis, properties and electrical applications - Solders : composition and uses – Capacitors : synthesis and modification of capacitor materials, fabrication.

MODULE II FUEL CELLS 7

Difference between batteries and fuel cells - classification of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC), and solid oxide fuel cells (SOFC) microbial fuel cell, - hydrogen storage materials, challenges in using hydrogen as a fuel.

MODULE III SENSORS 7

Definition, receptor, transducer, classification of chemical sensors based on operating principle of transducer, Ion-selective electrodes, Conductometric gas sensors (chemoresistors), Electrochemical sensors, Potentiometric MOSFET gas sensor, Touch sensors (oximeter, glucometer), Chemocapacitors, Biochips and microarray.

MODULE IV ANALYTICAL TECHNIQUES 9

Voltammetry: cyclic voltammetry, electrogravimetry - principle, instrumentation and applications of: UV-Vis spectrophotometry, Atomic emission spectroscopy-Photoluminescence spectrophotometry, atomic absorption spectrophotometry –- FT-IR spectroscopy, Raman spectroscopy, TGA-DTA analyzer, TEM.

L – 30;Total Hours –30

TEXT BOOKS:

1. P.C. Jain & Monica Jain, Engineering Chemistry, Dhanpatrai Publishing Company (P) Ltd., New Delhi (2016).

REFERENCES:

1. K.M. Gupta & Nishu Gupta, Advanced electrical and electronic materials: process and applications, Wiley-Scrivener (2015).
2. S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Ltd., New Delhi (2011).
3. B. Viswanathan & M. Aulice Scibioh, Fuel Cells: Principles and Applications, University Press (2008).

COURSE OUTCOMES:

CO1: Illustrate the construction and applications of electrical and electronic devices.

CO2: Classify the fuel cells and elaborate the different types of fuel cells.

CO3: Explain the different types of sensors and their applications.

CO4: State the principle and illustrate the instrumentation of various analytical techniques.

Board of Studies (BoS) : 11thBoS of Chemistry held on 17.06.2021

Academic Council: 17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	L	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	H	-	-	-	-	-	M	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	H	-	-	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

CHDX 04	FUNCTIONAL MATERIALS AND APPLICATIONS	L	T	P	C
SDG: 11, 12		2	0	0	2

COURSE OBJECTIVES:

To make the students conversant with

COB1: specific materials for hardware components fabrication, data storage and their related properties

COB2: selection of advanced materials for various current applications

COB3: materials for the fabrication of sensors

COB4: essential characterization techniques and software tools with chemistry background

MODULE I MATERIALS FOR HARDWARE AND DATA STORAGE 7

Specific materials for electrical and electronic gadgets-computers, instruments (Semiconductors-N, S doped Silicon, CdX QDs, metal nano and other applications). Networking of networks and connecting devices - materials used in robotic construction (metal alloys, kevlor, biodegradable smart materials). Data storage and magnetic hard disk and devices- pendrive (flash memory-ferro magnetic and super paramagnetic materials, optical dics). Nanomaterials to enhance the lifetime and storage of CD, DVD and BD (Nano incorporated Polycarbonate, Al and lacquer) - Nanomaterials and small molecules for data storage.

MODULE II ADVANCED MATERIALS AND APPLICATIONS 8

Materials for 3D printing (Nylon, ABS, PLA, Ti, Au and Ag). Solar panels function monitoring-IOT enabled (crystalline Si, organometallics) – Displays and LCD, LEDs and its types-OLEDs (Group III-V materials). RGB analysis -sensing and TV/system screen (QDs and anthocyanins). Semiconductor chemistry for VLSI processing technology (metalloid staircase, Si, Ge, GaAs)-materials for inkjet printable circuit board (nanocarbon based) - Right material for signal speed and right thermal coefficient of expansion - Remote sensing (photodectectors and radiometers). Solder:-Lead based solder - issues and alternative for lead free solder (Conductive inks).

MODULE III MATERIALS FOR FABRICATION OF SENSORS 8

Wireless Sensors – Introduction to sensors (chemo/bio/gas sensors)-Wearable/touch sensors-Components - selection of materials - Device fabrication and function monitoring - wireless, Smartphone based and IOT enabled-

Properties of materials, anti-corrosive, water proof, insulation and lamination. Robotics in surgery, gene coding and molecular modelling. Biochips and DNA microarray chips(fluorescent dyes, glass/nylon).

MODULE IV ANALYTICAL TECHNIQUES AND SOFTWARE SOLUTIONS **7**

Characterization tools – UV-Visible (DRS), FT-IR, SEM, TEM, AFM, TG-DTA anDXRD (Principle and applications only). Introduction to softwares- ChemOffice, Image J, Origin - Molecular modelling, comparison of old drug structures with new, drug designing-drug for COVID-19 and drug delivery. Molecular docking (drug interaction in a human body).

L – 30;Total Hours –30

TEXT BOOKS:

1. P. Roy, S.K. Srivastava, Nanomaterials for Electrochemical Energy Storage Devices (Book), John Wiley & Sons, 2019.
2. K. Brun, T. Allison, R. Dennis, Thermal, Mechanical, and Hybrid Chemical Energy Storage Systems (Book), Elsevier, 2000.

REFERENCES:

1. B.J. Cafferty, A.S. Ten, M.J. Fink, S. Morey, D.J. Preston, M. Mrksich, G.M. Whitesides, Storage of Information Using Small Organic Molecules, ACS Central Science, 2019, 5, 911−916.
2. Nabeel Ahmad P. Gopinath and Rajiv Dutta, 3D Printing Technology in Nanomedicine (Book), Elsevier, 2019.
3. Aaftaab Sethi, Khusbhoo Joshi, K. Sasikala and Mallika Alvala, Molecular Docking in Modern Drug Discovery: Principles and Recent Applications, IntechOpen, (2019), DOll: 10.5772/intechopen.85991.
4. W-L. Xing, J. Cheng, Frontiers in Biochip Technology, Springer, 2006.
5. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, 3rd Edition, Springer, 2015.

COURSE OUTCOMES:

CO1: Identification of suitable materials in electronic gadgets and data storage systems.

CO2: Application of specific functionalized materials for advanced applications

CO3: Choose appropriate materials for fabricating the different types of sensors

CO4: Hands on experience of software and exposure to material properties

Board of Studies (BoS) :
15th BoS of Department of Chemistry held on 15.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	-	L	-	H	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	H	-	-	-	-	-	-	-	-
CO3	-	-	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	H	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG: 11 &12

Statement : Identification of suitable materials towards the manufacturing of electronic gadgets and data storage systems without much affecting the natural resources and application of the fabricated devices to the sustainable cites and communities.

CHDX 05	**CHEMISTRY OF FUELS,**	**L**	**T**	**P**	**C**
SDG: 9	**COMBUSTION AND LUBRICANTS**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

The students will be conversant with

COB1:types, composition and process of manufacture of solid, liquid and gaseous fuels.

COB2:determination of calorific value and calculation of GCV and NCV.

COB3:types, concepts of corrosion and different methods for control of corrosion.

COB4:types, functions of lubricants and mechanism of lubrication.

MODULE I FUELS 8

Introduction – classification of fuels – calorific value – characteristics of a good fuel – comparison of solid, liquid and gaseous fuel – solid fuels – coal – ranking of coal – proximate analysis of coal – pulverised coal – metallurgical coke – manufacture of coke (Otto Hoffman) – Liquid fuel – petroleum – refining of petroleum – cracking – fixed bed catalytic cracking - synthetic petrol – Fischer-Tropsch process – biodiesel - Gaseous fuel – CNG – LPG – Biogas – producer gas – water gas

MODULE II COMBUSTION 8

Introduction – calorific value - Calorific value: Gross and net calorific value - Bomb Calorimeter - Gas calorimeter - Definition of combustion – theoretical calculation of calorific values (Dulong's formula) - Gross and net calorific values (problems) - air-fuel ratio - minimum requirement of air for complete combustion of fuels (problems) — Analysis of flue gas - Orsat's gas analysis method

MODULE III CHEMISTRY OF CORROSION 7

Types of corrosion - chemical corrosion – electrochemical corrosion – galvanic corrosion – differential aeration corrosion - factors influencing rate of corrosion.

Corrosion control – selection of materials - cathodic protection: sacrificial anode - corrosion inhibitors – paints: constituents & functions – treatment of metal surface for inorganic coatings - metallic coatings: hot dipping: galvanizing and tinning – electroplating — electroless plating.

MODULE IV LUBRICANTS 7

Introduction – functions of lubricant- mechanism of lubrication - classification of lubricant – selection of lubricants - lubricating oils-properties of lubricant: viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue - semisolid: grease (sodium, calcium, lithium, aluminium) - solid lubricant: graphite, graphene, molybdenum disulphide – lubricating emulsions - cutting fluids – synthetic and semi-synthetic lubricants.

L – 30;Total Hours – 30

TEXT BOOKS:

1. Jain P.C and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co., New Delhi. 2016.

REFERENCES:

1. Stephen R Turns, “An Introduction to Combustion: Concepts and Applications”, McGraw Hill Education, July 2017,
2. Samir Sarkar, “Fuels and Combustion”, University Press, 2009
3. Dipak K Sarkar “Thermal power plant: Design and operations – Chapter-3”, Elsevier, 2015.
4. E. McCafferty, “Introduction to Corrosion Science” Springer, May 2010.
5. Don M Pirro, Martin Webster, Ekkehard Daschner “Lubrication Fundamentals”, Taylor & Francis Gp,LLC, 2016.
6. Theo Mang, Wilfred Dresel “Lubricants and Lubrication” Wiley-VCH, 20172nd Edition, India, 2012. (ISBN 13: 9788131704370)

COURSE OUTCOMES:

The students will be able to

CO1:compare and interpret the different purpose of application, composition, and calorific value of different fuels.

CO2:calculate the minimum amount of air required, GCV and NCV for the combustion of the fuels.

CO3:apply specific methods to control corrosion of different materials.

CO4:analyze and choose the right type of lubrication based on the type of machines.

Board of Studies (BoS) :
11thBoS of Chemistry held on 17.06.2021

Academic Council:
!7th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	-	-	-	-	M	-	-	-	-	-	-	M	-
CO2	H	H	-	L	-	-	M	-	-	-	-	-	-	L	-
CO3	H	L	-	-	-	-	-	-	-	-	-	-	M	M	-
CO4	H	M	-	-	-	-	L	-	-	-	-	-	M	L	-

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9: Industry, Innovation & Infrastructure

The holistic understanding of the materials used as fuels and lubricants and devices towards sustainable solutions for the advances in mechanical systems.

CHDX 06	INSTRUMENTAL METHODS OF POLYMER ANALYSIS	L	T	P	C
SDG4		2	0	0	2

COURSE OBJECTIVES:

To impart knowledge on

COB1:to impart knowledge on spectroscopic analysis of polymers.

COB2: to equip with the knowledge of optical methods anDX-ray diffraction methods for understanding the morphology and orientation of molecules

COB3: to develop an understanding on separation of various mixtures by different chromatographic techniques.

COB4: to understand the chemical elemental structure of polymers by NMR and mass spectroscopic technique.

MODULE I ULTRAVIOLET, VISIBLE AND IR SPECTROSCOPY 9

Principle- Instrumentation-Double beam spectrophotometers – single beam spectrophotometers -sources of radiation – Detectors – I operational procedure – qualitative and quantitative analysis – applications in polymer analysis.

Fourier Transform Infrared Spectroscopy -principle- instrumentation – optical materials – sources- detectors – typical spectrophotometers –– calibration and standardization – sample preparation - analysis – interpretation of FTIR spectra-principle of identification and characterization of polymers using IR

MODULE II NMR SPECTROSCOPY 7

Fundamental concepts – chemical shift – spin –spin- coupling. Instrumentation - data acquisition and spectral interpretation. Solid state NMR (magic angle), Applications of NMR and FT NMR in the characterization of polymers

MODULE III CHROMATOGRAPHY AND THERMAL ANALYSIS 7

Thermal analysis: DSC, TG/DTA, TMA, DMA, DETA with examples. gel permeation chromatography (GPC) – High pressure liquid chromatography (HPLC) – Thin layer chromatography (TLC - Gas chromatography (GC) – sample preparation. Chromatographic process and instrumentation – compositional separation and detectors – various types – Analyses. The uses and applications of various chromatographic techniques – pyrolysis gas chromatography.

MODULE IV X-RAY DIFFRACTION & NEWTON SCATTERING 7

Principle & basic concept of absorption of X-rays- monochromatic X-ray sources – X-ray detectors - Instrumentation – Experimental technique -Analysis by X-ray

absorption. Absorption apparatus – X-ray diffraction – Diffraction apparatus. Application to polymer analysis.

L - 30;Total Hours – 30

TEXT BOOKS

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch “Principles of Instrumental Analysis” 7th edition, Publisher Cengage Learning ,2016
2. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, “Introduction to Spectroscopy” 5th edition, Publisher Cengage Learning ,2015
3. Yang, Rui “Analytical methods for polymer characterization” CRC Press, 2018.
4. Joseph D. Menczel, R. Bruce Prime “Thermal analysis of polymers: fundamentals and applications” John Wiley, 2019.

REFERENCES:

1. Galen W. Euring, “Instrumental methods of chemical analysis”, McGraw Hill International editions, New York, 1985.
2. B.J. Hunt & MI Jones Blackie, “Polymer Characterisation”, Academic professional, London, 1997.
3. Hubert Lobo, Jose V.B.Bonilla, “Handbook of Plastic analysis” , Marcel Dekker inc, New York, 2003.
4. RA pethrick & JV Daukins, “Modern techniques for polymer characterization” , John Wiley & sons Chichester, UK, 1999.
5. D. Campbell and R. White, “Polymer characterization”, Chapman & Hall, London 1989.
6. Arza Seidel, “Characterization and Analysis of Polymers”, John wiley and sons, New jersey, 2008.
7. Nicholas P. Cheremisinoff, “Polymer Characterization: Laboratory Techniques and Analysis”, Noyes publications, New jersey, 1996.
8. John M Chalmers, Robert J Meier, “Molecular characterization and analysis of polymers” Elsevier, 2008

COURSE OUTCOMES

CO1: Gaining knowledge on principles of various instruments
CO2: Understand about various characterization techniques
CO3: Interpretation the polymer by different techniques

Board of Studies (BoS) :	**Academic Council:**
11thBoS of Chemistry held on 17.06.2021	!7th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	L	-	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	M	-	-	-	-	-	-	-	-	M	-	-
CO3	-	-	-	-	-	-	M	-	-	-	-	-	L	-	-
CO4	-	-	-	M	-	-	-	-	-	-	-	-	L	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 :Aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all

This course will provide deep knowledge on analysis of polymers using different instrumental methods.

CHDX 07	MEDICINAL CHEMISTRY	L	T	P	C
SDG: 9		2	0	0	2

COURSE OBJECTIVES:

To impart knowledge on

COB1:the basic factors governing drug design.

COB2: the software tools for molecular docking.

COB3:the synthetic pathway of antinfective, antineoplastic, cardiovascular and steroidal drugs.

COB4: the mode of action and side effects of synthetic drugs.

MODULE I INTRODUCTION TO DRUG DESIGN 7

Development of new drugs: Procedure followed in drug design – Literature survey - Search for Active Pharmaceutical Ingredient(s) - Molecular modification – Types of pharmaceutical form / mode of administration, Chemical Characterization of Medicinal Drugs - Molecular docking.

MODULE II ANTIINFECTIVE DRUGS 8

Synthesis, mode of action and side effect of Dapsone and Clofazimine (antileprotic) – Isoniazid, Rifampicin, Pyrazinamide and Ethambutol (antitubercular) – Fluconazole and griseofulvin (antifungal) – Chloroquine and Primaquine (antimalarial) - Semisytheticpencillin, Streptomycin, Ciprofloxacin (Antibiotics) - Nevirapine and Zidovudine (Antiviral)

MODULE III ANTINEOPLASTIC AND CARDIOVASCULAR DRUGS 8

Synthesis, mode of action and side effect of Mechlorethamine, Cyclophosphamide, Melphalan, Fluorouracil, 6-Mercaptopurine (Antineoplastic) – Sorbitrate, methylprednisolone, Methyldopa, quinidine (Cardiovascular).

MODULE IV STEROIDS AND RELATED DRUGS 7

Synthesis, uses and mode of action - (A) Androgens -testosterone (B) Estrogens and progestational agents – progesterone, (C) Adrenocorticoids – prednisolone, dexamethasone, Remdesivir (D) Glucocorticoids – Cortisol (E)Anabolicsteroids - nandrolone, oxandrolone (F) Neurosteroids – allopregnanolone.

L – 30; Total Hours –30

TEXT BOOKS:

1. An Introduction to Drug Design, S. N. Pandeya and J. R.Dimmock, New Age International, 1997.
2. Burgers's Medicinal Chemistry and Drug Discovery, Fifth Edition; M. E. Wolff, John Wiley and Sons, 1996.
3. The organic chemistry of drug design and drug action, R. B. Silverman and M. W. Holladay, Academic Press, 3rd Edition, 2014.
4. Introduction to medicinal chemistry**:** How Drugs Act and Why, A. Gringuage, Wiley-VCH, 1996.
5. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry; Eleventh Edition; Lippincott Williams & Wilkins, 2004.

REFERENCES:

1. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley, 2nd Edition 2008.

COURSE OUTCOMES:

CO1:Carry out searches to retrieve information relevant to the development of a new drug.

CO2:Describe and justify the role and importance of the various disciplines involved in the different phases of drug discovery and development.

CO3:Explain how synthetic methods are used to make early decisions in the drug discovery and development.

CO4:Elaborate the mode of action and side effect of the drugs.

Board of Studies (BoS) : 11thBoS of Chemistry held on 17.06.2021

Academic Council: 17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	M	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	M	-	-	-	-	-	-	-	-	M	-	-
CO3	-	-	-	-	-	L	-	-	-	-	-	-	L	-	-
CO4	-	-	-	M	-	-	-	-	-	-	-	-	L	-	-

Note: L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 :Industry, Innovation & Infrastructure

Understanding of drugs preparation and usage in sustainable method reduces unwanted side effects and help to environments.

HUMANITIES ELECTIVE –I
(SEMESTER III)

		L	T	P	C
SSDX 01	**ENGINEERING ECONOMICS AND MANAGEMENT**				
SDG: 4, 8, 9,12		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To present the major concepts and techniques of engineering economic analysis that is needed in the decision making process by providing insights to the basic microeconomic concepts of demand, supply and equilibrium.

COB2: To generate theoretical knowledge and understanding of macroeconomic aggregates such as national income and inflation and the major challenges associated with the measurement of these aggregates.

COB3: To develop analytical and critical thinking skills on money, banking and public finance and use them to judge the appropriateness of economic development and policy options.

COB 4: To introduce the basic concepts of management and planning and highlight the contribution of planning to the attainment of organization's objectives.

COB 5: To apprise the students about important management concepts and create awareness about the corporate social responsibilities and ethical aspects.

MODULE I DEMAND AND SUPPLY ANALYSIS 9

Introduction to Engineering Economics – Engineering efficiency – Economic efficiency - Scope of Engineering Economics, Engineers' contributions to economic growth- Problem solving and decision making - Laws of Demand and Supply - Difference between Microeconomics and Macroeconomics - Equilibrium between Demand and Supply, Elasticity of Demand - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 8

Concepts of National Income and measurement – GDP Growth Rate - Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – Meaning of Inflation, its types causes and preventive measures.

MODULE III MONEY, BANKING AND PUBLIC FINANCE 10

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary Policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) – Economic Reforms in India – LPG Policy.

MODULE IV PRINCIPLES OF MANAGEMENT AND PLANNING 8

Nature of management and its process - Importance of Management- Functions and Principles of Management - Nature, Purpose and Kinds of Planning.

MODULE V ENGINEERING MANAGEMENT 10

Strategic Management-Manager and Environment - Globalization and Technology Intermediation, Corporate Social Responsibility of business - meaning, importance, arguments for and against Corporate Social Responsibility - Business Ethics- Role of Ethics in Engineering Practice- meaning, importance - State intervention in business - Pros and Cons of intervention.

L – 45 ; Total Hours – 45

TEXT BOOKS:

1. Krugman, P, Wells, R, and Graddy, K., “Essentials of Economics”, Worth Publishers, 4th Edition, New York, 2016.
2. Hussain, Moon Moon, “Economics for Engineers”, Himalaya Publishing House, 1st Edition, New Delhi, India, 2015.

REFERENCES:

1. Andrew Gillespie, “Foundations of Economics”, OUP Oxford, England, 2007.
2. Acemoglu, D., Laibson, D., & List, J., “Microeconomics”, Pearson Education, 2nd Edition, Boston, 2017.
3. Brinkman John , “Unlocking the Business Environment”, Routledge, 1st Edition, London, United Kingdom, 2010.(ISBN 9780340942079)
4. Cleaver Tony, “Economics: The Basics”, Routledge, 3rd Edition, London, United Kingdom, 2014.
5. H. L. Ahuja, “Macroeconomics”, S Chand Publishing; Twenty Edition, New Delhi, India, 2019.
6. Koutsoyiannis A, “Modern Microeconomics”, Palgrave Macmillan, 2nd Edition, U.K, 2003.

7. R.A. Musgrave and P.B. Musgrave, “Public Finance in Theory and Practice” ,McGraw Hill Education India, Fifth Edition, India, 2017.
8. Mell Andrew and Walker Oliver, “The Rough Guide to Economics”, Rough Guide Ltd, 1st Edition, London, 2014.
9. R. Paneerselvam, “Engineering Economics”, PHI Publication, 2nd Edition, New Delhi, India, 2014.
10. Robbins S.P. Decenzo David A and Coulter, “Fundamentals of Management: Essential Concepts and Applications”, Pearson Education, 9th Edition, London, England, 2014.

COURSE OUTCOMES:

On successful completion of this course, students will be able to

CO1:interpret the forces driving demand and supply and their impact on market conditions.

CO2:demonstrate various dimensions of macroeconomic variables like national income, money supply, employment, etc. in analyzing the effects on business.

CO3:explicate the different aspect of Governmental activities and their rationality and describe how they can be pursued through fiscal and monetary policy.

CO4:develop skills to plan, organize, direct and control the resources of the organization for obtaining common objectives or goals.

CO5: augment managerial skills and adopt ethical practices in various functional areas and engineering practices.

Board of Studies (BOS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1		H	H	M		H	H				H	H
CO2		H	M			M					H	H
CO3			M	M		H	H		H			H
CO4						M	H	H	M		M	H
CO5						M	H	H	M		M	H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all.
SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.
SDG 12: Ensure sustainable consumption and production patterns.

Inclusive and equitable quality education can make a critical difference to production patterns, consumer understanding of more sustainably produced goods, promote inclusive and sustainable economic growth along with productive employment and decent work for all.

SSDX 02	**SOCIOLOGY OF SCIENCE AND TECHNOLOGY**	**L**	**T**	**P**	**C**
SDG: 17		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To recognize and define the basic concepts of society and the ways in which sociologists use these concepts in constructing explanations for individual and group problems.

COB2: To illustrate the convergence and divergence of sociology with engineering subjects in terms of the subject matter, nature and scope of the discipline and its approach.

COB3: To demonstrate the relationship between science, technology and society.

COB4: To understand the issues relating to science, technology and change in India both in the historical and globalization contexts.

COB5: To appraise the impact of science and technology on different socio-cultural institutions and processes.

MODULE I INTRODUCTION 8

Sociology - Definition, scope and importance, relationship with other social sciences - Major theoretical perspectives: Functionalism, Conflict Theorizing and Interactionism - Elements of social formation - Society, Community, Groups and Association - Institutions, family and kinship, religion, education, politics - Social process - Associative Social Process - Co-operation, Accommodation and Assimilation - Dissociative Social Process - Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 9

Culture - characteristics, functions, types, cultural lag and civilization - Socialization – process, stages, agencies and anticipatory socialization - Social Control - characteristics, importance, types and agencies - Social stratification. - Meaning, forms - caste and class.

MODULE III SCIENCE, TECHNOLOGY AND SOCIETY 9

Relationship between society and science and vice-versa - Science as a social system - Norms of science - Relationship between science and technology - History of modern science in India – colonial–independence and post-independence science - Science education in contemporary India – primary level to research level - Performance of universities in the development of technology - Interrelationship between industry and universities.

MODULE IV SCIENCE, TECHNOLOGY AND SOCIAL ISSUES 10

Technology, media, identity and global society - Conformity and deviance and role of science and technology - Technology and development issue - S&T and sustainable development -Role of science and technology in the creation of environmental crisis - Social inequality, social exclusion and digital divide - Science, technology and ethical issues -Gender and technology.

MODULE V GLOBALIZATION, SCIENCE, TECHNOLOGY AND CHANGE 9

Social Change - nature, direction, forms - Technology and rate of social change – Globalization - characteristics, historical and social context- Social consequences of science and technology on civil society - Globalization - Liberalization - Their impact on Indian science and technology - WTO and issues related to intellectual property rights - MNCs and Indian industry.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Giddens A. “Sociology” Wiley India Pvt. Ltd2017
2. Heald Haralambos, R.M “Sociology Themes and Perspectives”, Oxford, New Delhi-92. 2014
3. Sergio Sismondo. An Introduction to Science and Technology Studies Malden: Wiley Blackwell.2010
4. R.K. Merton, Sociology of Science, Theoretical and Empirical Investigations, University of Chicago Press, 1973.

REFERENCES:

1. Atal Yogesh, “Changing Indian Society” Rawat Publications, Jaipur, 2006.
2. Bilton, T. et al “Introductory Sociology”, Palgrave, New York. 2002
3. Das Gupta, Samir and ‘‘An Introduction to Sociology”, Pearson, Delhi. 2012.
4. Francis Abraham M. “Contemporary Sociology: An Introduction to Concepts and Theories”**,** New Delhi, Oxford University Press. 2014
5. Inkless, A, “What is Sociology”, Prentice Hall, New Delhi. 1987
6. Tumin, Melvin M “Social Stratification”, Prentice Hall, New Delhi. 1969.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: recognize the fundamental tenets of Sociology.

CO2: interpret the relationship between individual and society in a sociological perspective.

CO3: categorize and constructively identify their own assumptions about the relationships among society, science and technology

CO4: appraise the dynamics of human society with special reference to the science, technology and contemporary trends of globalization.

CO5: able to link and reflect on current and ongoing sociological debates on development and role of technology.

Board of Studies (BOS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H			H	H	M	L	H	L	
CO2			M			H	H	M	H	H	M	L
CO3			H	M	H	H	M		M	H	H	M
CO4			M			H	H	L	L	M	H	H
CO5			M			H				M		L

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

To inculcate knowledge and socialize youth in building participation, institutions and partnership for inclusive development for the implementation of sustainable development goals.

		L	T	P	C
SSDX 03	**INDUSTRIAL ECONOMICS AND MANAGEMENT**				
SDG: 8 and 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide a wholesome idea about the concept of industrial economics and identify the classifications of firms based on ownership and control.

COB2: To impart theoretical and analytical knowledge on the different market structures, pricing practices and government policies.

COB3: To equip the students with the framework that will be useful for applying economic models in business strategy, competition policy and regulations.

COB4: To understand the importance of Industrial Policy in the development of Industries in India.

COB5: To elucidate industrial growth in India by examining its performance and problems in industrial sector.

MODULE I INTRODUCTION TO INDUSTRIAL ECONOMICS 9

Definition and scope of industrial economics - Concept and importance of industry; Concept and organization of a firm - Classification of firms based on ownership - sector (industries, formal vs. Informal) - size and use - based classification - Separation of ownership and control - Localization of industries .

MODULE II MARKET STRUCTURE 9

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot Kinked Demand and Price Leadership – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing.

MODULE III PRODUCTION ECONOMICS AND THEORY OF FIRM 9

Production and Production function – Types, Factor Inputs – Input-Output Analysis**,** Undifferentiated Products - Cournot, Stackelberg, Dominant firm model, Bertrand-Heterogeneous products - Chamberlin's small and large number case - Kinked demand curve theory - Bain's limit pricing – Production Possibility Frontier.

MODULE IV INDUSTRIAL POLICY 9

Industrial Policy: Industrial Policy in India -1948, 1956, 1977, 1980, 1990, 1991 - Industrial Performance after Independence.

MODULE V INDUSTRIAL GROWTH IN INDIA 9

Trends and prospects - Public enterprises; efficiency - Productivity and performance constrain - Small scale industries: definition, role - Policy issues and performance - Capacity utilization - Industrial sickness and Exit - Technology transfer - Privatization.

L – 45 ; Total Hours – 45

TEXT BOOKS:

3. Barthwal R R “Industrial Economics: An Introductory Textbook”, New Age International Pvt. Ltd Publishers, 2017
4. P.J. Devine, N. Lee, R.M. Jones, W.J. Tyson, “An Introduction to Industrial Economics”, Routledge.2019.

REFERENCES:

1. Ferguson, Paul R. and Glenys J. Ferguson, “Industrial Economics - Issues and Perspectives”, Macmillan, London. 1994
2. Gregory Mankiw “Principles of Microeconomics”, Havcourt Asia Publishers, 2001.
3. Mohanty Binode Ed. “Economic Development Perspectives”, Vol. 3, Public Enterprises and Performance, Common Wealth Publishers, New Delhi, 1991
4. Mote and Paul “Managerial Economics, Tata McGraw Hill, 2001
5. Peterson and Lewis “Managerial Economics”, 4th Ed., Prentice Hall, 2004

COURSE OUTCOMES:

CO1: Develop knowledge on the concept and organization of firms and the implications of the separation of ownership and control.

CO2: Acquire familiarity with various market structures and formulate appropriate pricing strategies.

CO3: Think analytically using various economic models concerning market structures and apply them to the real world of industry.

CO4: To compare the various Industrial Policies introduced in India and recognize the role of these policies in making required industrial development in India.

CO5: Clearly diagnose and illustrate the challenges in industrial economy in India and develop effective and comprehensive solution on them.

Board of Studies (BoS) :	**Academic Council:**
Mention details of BoS	18th Academic council held on
5thBoS of SSSH held on 29.12.2021	24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1			H	M			H		M		M	L
CO2			H		M		H		M		M	L
CO3			H				H		M		M	M
CO4			H				H		M		H	M
CO5			H				H		M		H	M

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation.

A comprehensive and holistic approach towards the way for sustainable development and economic growth through the inclusive economic strategy and thereby to reduce the poverty, hunger among people by familiarizing them industry and its importance as survival strategy for earning decent standard of living.

SSDX 04	**DYNAMICS OF INDIAN SOCIAL STRUCTURE**	**L**	**T**	**P**	**C**
SDG: 10, 16		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide knowledge on the components of the Indian social structure.

COB2: To learn the nature and contemporary structure of Indian social institutions.

COB3: To sensitize students about social stratification in Indian Society.

COB4: To create awareness about the social problems occurring in contemporary India.

COB5: To explicate the changing institutions, the processes, the agents and the interventions that brings about change in the Indian society.

MODULE I INDIAN SOCIAL STRUCTURE 9

Demographic composition - Racial, religious, ethnic and linguistic -Types of communities - rural, urban, agrarian and tribal - Social backwardness - OBC, SC, ST and EWS - Indian minorities- religious, ethnic, linguistic and LGBT.

MODULE II INDIAN SOCIAL INSTITUTIONS 9

Family - types, characteristics, functions of family - Joint Family- definition features, functions of joint family , dysfunctions of joint family, disintegration of joint family – Marriage - definition, characteristics, marriage as sacrament or contract.

MODULE IIISOCIAL STRATIFICATION IN INDIA 9

Social stratification - Concept of hierarchy - inequality, meaning and characteristics - Social Stratification and Social Mobility - Functions of Social Stratification - Caste, definition, principles, contemporary changes, dominant caste - Caste - class interface - Religious minorities.

MODULE IV SOCIAL PATHOLOGY 9

Social Problem - nature, social disorganization - Population explosion- causes, effects, relationship with development - Child Labour- causes, magnitude and consequences – Unemployment - nature, types, causes and effects - Gender issues - social status of women, violence against women and women in work place - Contemporary issues - communalism, terrorism and corruption.

MODULE V SOCIAL CHANGE IN INDIA 9

Socio-cultural change - Sanskritization – Westernization - Secularization, Modernization - Processes of Social change - Industrialization – Urbanization – Globalization - Social movement - concept, characteristics, functions - New social movement-Women and Environment movement.

L – 45; Total Hours –45

TEXT BOOKS:

1. Sharma,K.L., “Indian Social Structure and Change”, Jaipur: Rawat Publications, 2008.
2. Ahuja Ram., “Social Problems in India”, Rawat Publication: New Delhi, 2014.
3. Ahuja Ram., “Society in India”, Rawat Publication: New Delhi, 2014.

REFERENCES:

1. Atal Yogesh, “Changing Indian Society” Rawat Publications, Jaipur, 2006.
2. Dube S.C., “India's Changing Villages: Human Factors in Community Development”, London, Routledge and Kegan Paul, 2003.
3. Hasnain N., “Indian Society: Themes and Social Issues”, Mc Graw Hill, 2019.
4. Jayapalan, N., **“**Indian Society and Social Institutions” Atlantic Publishers, 2001.
5. Pandey Vinita., “Indian Society and Culture”, Rawat Publications, New Delhi, 2016
6. Rao Sankar., “Sociology of Indian Society”, S. Chand Publisher, New Delhi, 2004.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1:explain about the social structure and social institutions that constitute society in India.

CO2:differentiate the various categories of inequalities and their challenges.

CO3: describe the social stratification and its impact in society.

CO4:analyze the social problems encountered in contemporary India.

CO5:correlate the various forms and trends of the social change in Indian society and realize the relevance of their role in bringing about development.

Board of Studies (BoS) :

5thBoS of SSSH held on 29.12.2021

Academic Council:

18th Academic council held on

24.02.2022

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H			H	M			M		
CO2			M			M	H	L				H
CO3			M			M	H	L				H
CO4			H			H	H		M			M
CO5			H		H	M	H	M		H		H

Note: L- Low Correlation M - Medium Correlation H -High Correlation

SDG 10: Reduce inequality within and among countries.
SDG16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

To sensitize and impart pertinent knowledge to youths to combat the contemporary issues and challenges facing Indian society in order to remedy its social pathos and injustices in the path of achieving sustainable development in India.

MATHEMATICS ELECTIVE
SEMESTER III

		L	T	P	C
MADX01	**TRANSFORMS AND PARTIAL**				
SDG: 4	**DIFFERENTIAL EQUATIONS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To formulate and solve partial differential equations of first, second and higher orders

COB2: To introduce basics and engineering applications of Fourier series

COB3: To develop Fourier transform techniques

COB4: To introduce analytic solutions of PDEs by using Fourier series

COB5: To acquaint with Z -Transform techniques for discrete time systems

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 9+3

Fourier Series and Dirichlet's conditions - General Fourier series – Even and Odd functions - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 9+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES 9+3

Applications of Fourier series to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete and point Spectrum and Single pulse.

MODULE V Z – TRANSFORM 9+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution

Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1 Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011.

2. Grewal B.S., “Higher Engineering Mathematics”, 44th edition, Khanna Publishers, New Delhi, 2017.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2010.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:form and solve the partial differential equations using different methods

CO2:derive a Fourier series of a given periodic function by evaluating Fourier coefficients

CO3:apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms

CO4: solve partial differential equations by using Fourier series

CO5:solve difference equations using Z-transform

Board of Studies (BoS) :	**Academic Council:**
12th BOS of Mathematics & AS held on 23.06.2021	17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M														
CO2	M														
CO3	H														
CO4	M														
CO5	M														

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical techniques like matrices and calculus will lead to knowledge of applications in Computer Science

MADX02	DISCRETE MATHEMATICS	L	T	P	C
SDG: 9		3	1	0	4

COURSE OBJECTIVES:

COB1: To introduce logical and mathematical ability to deal with abstraction

COB2: To acquaint with the concepts of predicate calculus.

COB3: To introduce the notations and concepts used in set theory

COB4: To apply and use the terms function, domain, codomain, range, image, inverse image and composition

COB5: Tointroduce basic concepts from abstract algebra, especially the essential concepts in group theory.

MODULE I PROPOSITIONAL CALCULUS 9+3

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 9+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III SET THEORY 9+3

Basic concepts –Notations-Subset –Algebra of sets –The power set – Ordered pairs and Cartesian product- Relations on sets – Types of relations and their properties – Relational matrix and the graph of a relation – Partitions – Equivalence relations –Partial ordering –Poset – Hasse diagram – Lattices and their properties– Boolean algebra – Homomorphism.

MODULE IV FUNCTIONS 9+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE V ALGEBRAIC SYSTEMS 9+3

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.
2. Kenneth H.Rosen, "Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

REFERENCES:

1. Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. C.L.Liu, D.P.Mohapatra, "Elements of Discrete Mathematics", 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:form truth tables and write principal normal forms

CO2:write the negation of a quantified statement involving either one or two quantifiers.

CO3:prove that a proposed statement involving sets is true, or give a counterexample to show that it is false.

CO4:compute the connection between bijective functions and inverses. Be able to find the inverse of an invertible function.

CO5: give intrinsic structure of groups both abstract and specific examples illustrating the mathematical concepts involved.

Board of Studies (BoS) :
12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H														
CO2	M														
CO3	M														
CO4	H														
CO5	M														

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 9 : Sustainable Industry, innovation and Infrastructure

Learning of various techniques in functions and set theory will lead to knowledge required for applying in Computer Science projects.

MADX03	PROBABLITY AND STATISTICS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To impart knowledge on the basic concepts of probability

COB2: To understand random variables and distribution functions

COB3: To acquaint with joint density function and generating functions

COB4: To introduce sampling techniques and estimation

COB5: To perform hypothesis testing and draw inference

MODULE I BASIC PROBABILITY CONCEPTS 9+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II RANDOM VARIABLE AND DISTRIBUTION FUNCTIONS 9+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 9+3

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables- Generating functions.

MODULE IV SAMPLING AND ESTIMATION 9+3

Sampling distributions – basic knowledge on Random, simple random, stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 9+3

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill New Delhi, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, New Jersey 1999.
3. S.P.Gupta, “Applied Statistics”,Sultan Chand & Sons 2015.

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier 2016
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons New Delhi 2012
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, New Delhi 2007.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:do problems on probability, Baye’s theorem and descriptive statistics.

CO2:evaluate moment generating functions and calculate probabilities using distributions.

CO3:calculate probabilities and derive the marginal and conditional distributions of bivariate random variables

CO4:classify random samplings and calculate point and interval estimates

CO5: : make an informed decision, based on the results of inferential procedures

Board of Studies (BoS) :
12th BOS of Mathematics & AS held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L													
CO2	M	L													
CO3	M	L													
CO4	M	L		L											
CO5	H	L		L											

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various statistical methods will lead to knowledge of applications in Data Science and Computing

MADX05	NUMERICAL METHODS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To familiarize with the methods of solving equations numerically

COB2: To introduce interpolation techniques and finite difference concepts

COB3: To acquire knowledge on Numerical differentiation and integration

COB4: To solve ordinary differential equations numerically

COB5: To solve partial differential equations numerically

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 9+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 9+3

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Numerical differentiation using Newton's forward and backward formulae – Numerical integration: Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods.

MODULE V BOUNDARY VALUE PROBLEMS FOR PDE 9+3

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers,New Delhi, 2007.
2. Gerald C.F., P.O.Wheatley, “Applied Numerical Analysis” , Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, New York, 2006.
2. Jain M.K., S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003
3. Sastry.S.S,”Introductory Methods of Numerical Analysis”,Fifth Edition,PHI Learning Private Ltd., New Delhi, 2012

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: solve algebraic, transcendental and system of equations by numerical methods

CO2:apply various interpolation techniques and finite difference concepts

CO3:carry out numerical differentiation and integration using different methods whenever regular methods are not applicable

CO4: solve first order ODE using single and multi step methods

CO5: solve the boundary value problems in PDE by finite differences

Board of Studies (BoS) :
12th BOS of Mathematics and AS department held 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H														
CO2	M														
CO3	M														
CO4	M														
CO5	M														

Note:L- Low Correlation M -Medium Correlation H -High Correlation

SDG 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various methods in numerical analysis will lead to knowledge of applications in Data Science and Computing

HUMANITIES ELECTIVE – II
(To be offered in VI Semester)

SSDX 11	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**L**	**T**	**P**	**C**
SDG: 1-17		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To inculcate the knowledge base on sustainable development with a view to balance our economic, environmental and social needs, allowing prosperity for now and future generations.

COB2: To develop a capacity to undertake a theoretically grounded analysis of environment issues and identify and describe what the United Nations and other governing bodies are doing to assist in a more sustainable world.

COB3: To have an insight of the emerging debate about reconciling ecological sustainability with poverty alleviation in the context of globalization and development.

COB4: To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 8

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components – Sustainable Development Goals – Quality education, Gender equality, innovation and infrastructure, peace and justice - Sustainable engineering practices.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 6

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.

International responses to environmental challenges - Global policy such as Kyoto Protocol, Paris Agreement, Montreal Protocol, Basel Convention.

Community Participation in Sustainable Development, Common Property Resource Management, Innovation, Industry and Sustainable Development.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 7

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability - Globalization and Global Governance. Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT **9**

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.

Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L –30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, “An Introduction to Sustainable Development”, Glen Educational Foundation, 1st Edition, England, UK, 2008.

2. Sayer, J. and Campbell, B, “The Science of Sustainable Development: Local Livelihoods and the Global Environment” (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.

REFERENCES:

1. Anderson, David A, “Environmental Economics and Natural Resource Management”, Routledge, 3rd edition, England, UK, 2010.
2. Berck, P., “The Economics of the Environment”, New Delhi: Pearson India, 2015.
3. Karpagam M, “Environmental Economics: A Textbook.pdf”, Sterling Publishers Pvt. Ltd, New Delhi, 2021.
4. Kumar, Pushpam, “Economics of the Environment and Development”,Ane Book Publication, New Delhi, India, 2009.
5. Karpagam M and Jaikumar Geetha, “Green Management Theory and Applications”, Ane Books Pvt. Ltd, New Delhi, India, 2010.
6. Sengupta Ramprasad, “Ecology and Economics: An Approach to Sustainable Development”, Oxford University Press, New Delhi, 2004.
7. Muthukrishna, S, “Economics of Environment”, PHI Learning Pvt. Ltd., New Delhi, India, 2010.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO1: Develop awareness of the ethical, economic, social and political dimensions that influence sustainable development.

CO2: Clearly articulate their views and beliefs with regards to environmental issues.

CO3: Identify and describe the major economic forces that shape our approach to the environment issues and demonstrate responsible globalization through global governance.

CO4: Account for strategies, international agreements and major policy instruments for a sustainable use of resources and ecosystem services.

Board of Studies (BoS) : 4thBoS of SSSH held on 28.06.2021

Academic Council: 17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1		H	H		H	H	H		H		H	H
CO2			H			H	H		H		H	H
CO3	M	M	H			H	H		H		H	H
CO4			H			H	H	H	H		H	H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 1: End poverty in all forms and everywhere.

SDG 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

SDG 3: Ensure healthy lives and promote well-being for all at all ages

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

SDG 5: Achieve gender equality and empower all women and girls

SDG 6: Ensure availability and sustainable management of water and sanitation for all.

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

SDG 10: Reduce income inequality within and among countries

SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.

SDG 12: Ensure sustainable consumption and production patterns

SDG 13: Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The holistic understanding of all the 17 SDGs aims to end poverty, ensure prosperity, and protect the planet.

		L	T	P	C
SSDX 12	**SOCIOLOGY OF INDUSTRIAL RELATION**				
SDG: 8, 9		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To familiarize sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.

COB2: To highlight the structure and functions of industrial organizations

COB3: To explicate the dynamics of organizational behavior, leadership and communication.

COB4: To provide an overview in labour legislation and labour welfare

MODULE I INTRODUCTION 7

Sociology of Industrial relation - definition, scope and importance - Theoretical approaches- scientific management, human relations approach, theory of bureaucracy- Fordism and post-fordism - Production system- concept and characteristics of factory system - automation and rationalization -The Industrial Employment (Standing Orders) Act, 1946 Industrial conflict-strike, lockout and trade unions- Emerging role of trade unions in India.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility - Informal organization- definition, characteristics, types and relevance - Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction- Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 7

Group dynamics- Definition, Group behaviour model - Group decision making process, group cohesiveness - Leadership- definitions, style and effective supervision- Communication- concepts, types, model barriers - Job satisfaction- nature, employee compensation and job satisfaction. Grievance Handling and Disciplinary Action, Code of Conduct, Industrial Relations in changing scenario, Employers' organisations.

MODULE IV LABOUR LEGISLATION AND LABOUR WELFARE 9

Labour Legislation-Objectives, Principles, Classification and Evolution. International Labour Organisation. Social Justice and Labour Legislation, Indian Constitution and Labour Laws- The Factories Act, 1948, The Inter-state Migrant Workmen Act, 1979, The Contract Labour (Regulation and Abolition) Act, 1970, The Child Labour (Prohibition and Regulation) Act, 1986. Labour welfare-Concept, Scope, Types, and Principles, Industrial Health and Hygiene, Industrial Accidents and safety, Occupational Diseases. Social Security-Concept and Scope, Social Assistance and Social assurance.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Mamoria ,Gankar., “Dynamics of Industrial relations”, Himalaya Publishing House,Mumbai, 2007.
2. Narender Singh ., “Industrial Sociology”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
   Kumar., “Industrial Sociology”, Lakshmi Narain Agrawal Publishers, Agra, 2019.
3. SharmisthaBhattacharjee, “Industrial Sociology”, Aavishkar Publishers, Jaipur, 2016.

REFERENCES:

1. Bhatnagar M., “Industrial Sociology”,S. Chand Publications, New Delhi, 2012.
2. MisraRajan., “Industrial Sociology”, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.), New Delhi, 2013.
3. Newstorm W John, “Organizational Behavior”, Mc. Graw Hill Publishing Co., New Delhi, 2006.
4. Nina, Bandlej (ed)., “Economic Sociology of Work”, Bingley: Emerald Group Publishing Ltd, 2009.
5. Richard Brown, John Child, S.R. Parker, “The Sociology of Industry”, Routledge Publisher, 2015.
6. Sushil Kumar Saxena, Satish Mittal, “Industrial Sociology”,Common Wealth Publishers, 2012.
7. Watson, Tony, “Sociology, Work and Industry (5th edition), Oxon: Routledge, 2008.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Understand the sociological perspectives for dealing with social relationships in production and service organizations.

CO2: Have deeper knowledge in structure of authority, roles and responsibility in organizational settings.

CO3: Assess the role of leadership, communication and behavioral acumen to govern the organization.

CO4: Describe the importance of labour legislation and labour welfare

Board of Studies (BoS) : 4th BoS of SSSH held on 28.06.2021

Academic Council: 17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H						M	H		M
CO2						M	L	M	M		H	M
CO3			M			M		M	H	H	H	M
CO4						H						H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

The holistic understanding of industrial relations leads to equal access to opportunity, and equal pay for work of equal value for male and female contributions is necessary for gender equality as well as for inclusive economic growth. Explore work opportunities, understand career processes and appreciate the meaning and purpose of work in people's lives which leads to decent work and safe working practices.

SSDX 13	**PROFESSIONAL ETHICS AND**	**L**	**T**	**P**	**C**
SDG: 8	**HUMAN VALUES**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To render basic insights and inputs to the students to inculcate human values to grow as responsible human beings with a proper personality.

COB2: To create awareness on senses of engineering ethics.

COB3: To inculcate knowledge and exposure on safety and risk, risks benefit analysis and professional rights.

COB4: To instill social values and loyalty and to appreciate the rights of others

.

MODULE I HUMAN VALUES 7

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

MODULE II ENGINEERING ETHICS 7

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - Theories about right action - Self-interest - Customs and Religion - Uses of ethical theories - Valuing Time – Co-operation – Commitment.

MODULE III SAFETY, RESPONSIBILITIES AND RIGHTS 8

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

MODULE IV CONTEMPORARY ISSUES 8

Globalisation-Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Ethics-Ethics and codes of business conduct in MNC.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S., "Engineering Ethics", Prentice Hall of India, New Delhi, 2019.
2. Kiran. D R, "Professional Ethics and Human Values", Mc Graw Hill Publishers,New Delhi, 2013.
3. Naagarazan R.S., "Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2006.
4. R Sangal, RR Gaur and G P Bagaria, "Foundational Course in Human Values & Professional Ethics", Excel Books, India, 2010.

REFERENCES:

1. Charles D. Fleddermann , "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S.Protchard and Michael J Rabins., "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
6. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 2010.
7. Subramanian. R,"Professional Ethics - Includes Human Values", Oxford HED Publishers, 2017.\

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Apply moral and ethical values scrupulously that ought to guide the engineering profession.

CO2: Understand the ethical issues related to engineering aspects.

CO3: Assess safety and risk and execute risk benefit analysis.

CO4: Become responsible engineers, experimenters, researchers or businessmen

Board of Studies (BoS) :
4th BoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H				H	H				M
CO2			M			M		H		H	M	
CO3			M		M	H		H				H
CO4			L				H	H	H		M	M

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 8 :Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Holistic understanding of professional ethics explores work opportunities, understand career processes and appreciate the meaning and purpose of work in people's lives leading to a decent work and safe working practices and environments.

SSDX 14	**GENDER, TECHNOLOGY AND DEVELOPMENT**	**L**	**T**	**P**	**C**
SDG: 8		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1: To conceptualize what is gender and sex and draw a line of distinction between the two.

COB2: To develop students' sensibility to the difference in gender roles, responsibilities, rights and injustice.

COB3: To reflect critically on the ways in which new technologies have sharpened and/or blurred gender difference.

COB4: To develop an insight to the gender and development with the paradigm shift from time to time.

MODULE I UNDERSTANDING GENDER 7

Basic Concepts: Sex/Gender, Gender roles, Gender socialization, - Construction of Gender- Making Women, Making Men Gender stereotyping, Femininity and Masculinity, Patriarchy, Heteronormativity, LGBTIQ - Theoretical Background to gender and feminist thinking: Liberal, Radical, Marxist, Socialist, Post-modern Feminism.

MODULE II GENDER ROLES AND GENDER INJUSTICE 7

Gender Roles and Relations-Types of Gender Roles Gender Roles and Relationships Matrix. Health conditions, Sex Ratio, Education: Literacy & Gender Bias - Work Related Issues: Existing Prejudices, gender Related Violence, Gender Discrimination - Political participation: Lack of women's representation - Economic Conditions- Social Conditions: divorce, rape, domestic violence.

MODULE III GENDER, TECHNOLOGY AND CHANGE 8

A historical perspective – Technology as masculine culture – Household technology – medical technology: New Reproductive technologies – Impact of Technological Change on Women. The Digital Divide: Unequal Access, Unequal Effects – Outcome and impact of ICT's Policies and projects for women. How gender influences technologies and the social organization of scientific and technical workspaces.

MODULE IV GENDER AND DEVELOPMENT 8

Gender, Governance and Sustainable Development - Women's role in Development - Women in Development (WID), Women and Development

(WAD) - Gender and Development (GAD); Gender Mainstreaming and Gender Budgeting - Gender and Human Rights

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Bhasin, Kamala., "Understanding Gender", New Delhi: Kali for Women, 2000.
2. John, Mary E., "Gender and Development in India, 1970-90's: Some reflections on the constitutive role of context' Chaudhuri, Maitrayee. (ed.) Feminism in India", New Delhi: Kali for women. pp. 246-258, 2004.
3. Menon, Nivedita, "Embodying the Self: Feminism, Sexual Violence and the Law" in Partha Chatterjee and Pradeep Jeganathan (ed)- Subaltern Studies XI: Community, Gender and Violence", Permanent Black and Ravi Dayal, 2000.
4. Gender and Technology: A reader ., Edited by Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, John Hopkins University Press, Baltimore , 2003.

REFERENCES:

1. Lourdes Beneria , GünseliBerik , Maria Floro .,"Gender, Development and Globalization: Economics as if All People Mattered", 2nd edition , Routledge, 2015.
2. Moser, Caroline, "Gender Planning and Development: Theory, Practice and Training", Routledge, 1993.
3. Rege, Sharmila., "Sociology of Gender: The Challenge of Feminist Sociological Knowledge", Sage publications: New Delhi, 2003.
4. Jain S.C., Women and Technology, Rawat Publication, Jaipur Begh, 1985.

COURSE OUTCOMES:

At the end of the course, the students will be able to

CO1: Distinguish important concepts related to gender in contemporary society.

CO2: Interpret the gender discrimination works in our society and how to counter it.

CO3: Illustrate how the intersection of gender and technology involves gender shaping technology and technology shaping gender.

CO4: Apply gender sensitive perspective on development and human rights.

Board of Studies (BoS) :
4thBoS of SSSH held on 28.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			H			H	H		H		H	L
CO2			H			H	M			H		L
CO3			H			H	H	H			M	H
CO4			H			H	H		H			H

Note:L- Low Correlation M - Medium Correlation H -High Correlation

SDG 5: Achieve gender equality and empower all women and girls

To imbibe gender concern and gender perspective in the invention, and application of technology, planning and designing production and innovating strategies for engendering gender equality.