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 (I – IV semesters)
(Amendments updated upto February 2022)

B.Tech. CSE
(Cyber Security)

REGULATIONS 2021

CURRICULUM AND SYLLABI (I - IV Semesters)

(Amendments updated upto February 2022)

B.TECH. CSE (CYBER SECURITY)

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.

PROGRAMME EDUCATIONAL OBJECTIVES

- To introduce the fundamentals of science and engineering concepts essential for a computer engineer

- To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving

- To provide knowledge in computer science, modeling & design of computer based systems

- To impart knowledge to analyze, design, test and implement software required for various applications

- To hone personality skills, trigger social commitment and inculcate societal responsibilities.

PROGRAMME OUTCOMES

PO1: Analyse and build models applying the knowledge of mathematics, statistics, electronic, electrical and computer science discipline and solve the problem.

PO2: Identify the sources of information for data collection, design and conduct the experiments and interpret the result.

PO3: Think out-of-the box and solve the real time problems using their creativity in designing human friendly software systems.

PO4: Comprehend computer engineering concepts of the new research developments and apply them to develop relevant software and hardware products.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply the computing knowledge to solve the socially relevant problems.

PO7: Understand the impact of engineering solutions in global, economic, environmental, societal context and apply it in exploring the new developments, research trends and involve them in research.

PO8: Develop professional integrity by understanding and appreciating professional, legal, ethical, cyber security and related issues and act with responsibility.

PO9: Communicate, collaborate and work as a team by involving in the group projects of multi-disciplinary nature.

PO10: To prepare documents as per the standards and present effectively to improve software documentation skills.

PO11: Apply the hardware and software project management techniques to estimate the time and human resources required to complete computer engineering projects.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

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

PSO2: Apply standard practices and strategies in IT security products for successful career and entrepreneurship.

REGULATIONS - 2021
B.TECH. DEGREE PROGRAMMES
(Under Choice Based Credit System)

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 Everyprogramme 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 yearStudents

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 20% 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 Changeof 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 / academicorganisation. 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

14.1 A 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 ith course and GP_i is the Grade Point in the ith course,

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

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
- Information Technology
- Computer Science and Engineering (IoT)

- Mechanical Engineering
- Electrical and Electronics Engineering
- Aeronautical Engineering
- Biotechnology Engineering
- Computer Science and Engineering
- 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.	Block Chain	
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

13.	Computational Biology	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 ANDTECHNOLOGY
B.TECH. CSE (CYBER SECURITY)
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 Practices 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	CSD1201	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 2204	Operating Systems *	3	0	2	4
4.	PCC	CSD 2231	Computer and Information Security Fundamentals	3	0	0	3
5.	PCC	CSD 2205	Database Management System	3	0	0	3
6.	PEC		Professional Elective Courses	3	0	0	3
7.	PCC	CSD 2232	Information Security Laboratory**	0	0	2	1
8.	PCC	CSD 2207	Database Management System 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	Internet and Web Programming	3	0	0	3
2.	PCC	CSD3102	Artificial Intelligence and Machine Learning	3	0	0	3
3.	PCC	CSD 3104	Data Mining and Data Warehousing	3	0	0	3
4.	PCC	CSD 3133	Web and Mobile Application Security *	3	0	2	4
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.	HSC	GED 3101	Communication Skills for Career Success**	0	0	2	1
9.	PROJ	CSD 3107	Internship I ##	0	0	0	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 3235	Ethical Hacking	3	0	0	3
5.	PCC	CSD 3236	Intrusion Detection and Internet Security	3	0	0	3
6.	PEC		Professional Elective Courses				6
7.	PCC	CSD 3237	Ethical Hacking Laboratory **	0	0	2	1
8.	PCC	CSD 3238	Intrusion Detection and Internet Security Laboratory**	0	0	2	1
9.	HSC	GED 3201	Reasoning and Aptitude for Engineers**	0	0	2	1

Credits   **23**

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 4139	Contingency Planning and Disaster Recovery	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				9

Credits   **9**

Overall Total Credits – 166

*   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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LIST OF PROFESSIONAL ELECTIVE COURSES

SPECIALIZATION I: COMPUTER NETWORKS AND SECURITY

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
			SEMESTER – IV				
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				
4	PEC	CSDX 101	Queuing Theory	3	0	0	3
5	PEC	CSDX 102	Distributed Computing	3	0	0	3
6	PEC	CSDX 103	Cyber Laws and Ethics	3	0	0	3
7	PEC	CSDX 104	Virtualization Techniques	3	0	0	3
			SEMESTER – VI				
8	PEC	CSDX 221	Routing Protocols	3	0	0	3
9	PEC	CSDX 222	Intrusion Detection and Prevention	3	0	0	3
10	PEC	CSDX 223	Internet of Things	3	0	0	3
11	PEC	CSDX 224	Secure Interconnecting Systems	3	0	0	3
			SEMESTER – VII				
12	PEC	CSDX 121	Graph Theory and Application	3	1	0	4
13	PEC	CSDX 122	Quantum Computing	3	0	0	3
14	PEC	CSDX 123	Green Computing	3	0	0	3
15	PEC	CSDX 124	Security Evaluation and Assessment Methodology	3	0	0	3
16	PEC	CSDX 125	5G Wireless Communication Techniques	3	0	0	3

SPECIALIZATION II: INTERNET PROGRAMMING AND SERVICES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
SEMESTER – IV							
1	PEC	CSDX 204	Scripting Languages	3	0	0	3
2	PEC	CSDX 205	Information Retrieval	3	0	0	3
SEMESTER – V							
3	PEC	CSDX 105	XML and Webservices	3	0	0	3
4	PEC	CSDX 106	OpenSource Technologies*	3	0	0	3
SEMESTER – VI							
5.	PEC	CSDX 225	Full Stack Mobile Application Development I (Front end)	3	0	0	3
6.	PEC	CSDX 226	Web Analytics and Social Media Mining	3	0	0	3
SEMESTER – VII							
7.	PEC	CSDX 126	Full Stack Mobile Application Development II (Back end)	3	0	0	3
8.	PEC	CSDX 127	Web Security	3	0	0	3
9.	PEC	CSDX 128	Social Media Security	3	0	0	3

SPECIALIZATION III: COMPUTER GRAPHICS AND MULTIMEDIA

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
			SEMESTER – IV				
1	PEC	CSDX 206	Multimedia Design Program	3	0	0	3
2	PEC	CSDX 207	Sound Editing and Processing	3	0	0	3
			SEMESTER – V				
3	PEC	CSDX 107	Image Processing	3	0	0	3
4	PEC	CSDX 108	Computer Vision	3	0	0	3
			SEMESTER – VI				
5	PEC	CSDX 228	Advanced Computer Graphics	3	0	0	3
6	PEC	CSDX 229	Human Computer Interaction	3	0	0	3
7	PEC	CSDX 230	User Interface Design	3	0	0	3
			SEMESTER – VII				
8.	PEC	CSDX 129	Multimedia Security	3	0	0	3
9.	PEC	CSDX 130	Multimedia Communication and Networking	3	0	0	3
10.	PEC	CSDX 131	API Design	3	0	0	3
11.	PEC	CSDX 132	AAIP – Animation with Portfolio Development	2	0	2	3
12.	PEC	CSDX 133	Mobile Multimedia Systems	3	0	0	3

SPECIALIZATION IV: SOFTWARE ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
			SEMESTER–IV				
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				
3	PEC	CSDX 109	Software Metrics and Testing	3	0	0	3
4	PEC	CSDX 110	Software Requirements and Modeling	3	0	0	3
			SEMESTER– VI				
5	PEC	CSDX 231	Software Quality Assurance	3	0	0	3
6	PEC	CSDX 232	Software Integration and Maintenance	3	0	0	3
			SEMESTER– VII				
10	PEC	CSDX 134	Software Project Management	3	0	0	3
11	PEC	CSDX 135	Enterprise Resource Planning	3	0	0	3

SPECIALIZATION V: COMPUTER ARCHITECTURE AND APPLICATION ORIENTED COURSES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
			SEMESTER–IV				
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				
4	PEC	CSDX 111	Foundation on Robotics	3	0	0	3
5	PEC	CSDX 112	Statistics and Analytics using R Programming	2	0	2	3
6	PEC	CSDX 113	Essentials of Data Science	3	0	0	3
			SEMESTER– VI				
7	PEC	CSDX 233	Gaming Technology	3	0	0	3
8	PEC	CSDX 234	Cognitive Science	3	0	0	3
9	PEC	CSDX 235	High Performance Computer Architecture	3	0	0	3
10	PEC	CSDX 236	Natural Language Processing	3	0	0	3
11	PEC	CSDX 237	Multicore Architecture	3	0	0	3
12	PEC	CSDX 238	Service Oriented Architecture	3	0	0	3
			SEMESTER –VII				
13	PEC	CSDX 136	Programming in Data Science with Python	3	0	0	3
14	PEC	CSDX 137	Genetic Algorithm	3	0	0	3
15	PEC	CSDX 138	Advanced SAS: Macros and SQL	3	0	0	3
16	PEC	CSDX 139	Microservices Architecture (DevOps & Kubernetes)	3	0	0	3

17	PEC	CSDX 140	Advanced Game Design	3	0	0	3
18	PEC	CSDX 141	Dockers and Containers	3	0	0	3
19	PEC	CSDX 142	AI Chat Bot Application	3	0	0	3

CYBER SECURITY - ELECTIVES

SEMESTER - IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSDX 401	Fundamentals of Computer Forensics	3	0	0	3
2.	PE	CSDX 402	Open Source Software and Open Standards	3	0	0	3
3.	PE	CSDX 403	TCP/ IP	3	0	0	3
4.	PE	CSDX 404	Security Architecture	3	0	0	3
5.	PE	CSDX 405	Routing and Switching	3	0	0	3

SEMESTER - V

1.	PE	CSDX 301	Agile Software Development	3	0	0	3
2.	PE	CSDX 302	Network Troubleshooting Tools	3	0	0	3
3.	PE	CSDX 303	Malware Analysis	3	0	0	3
4.	PE	CSDX 304	IT Security Engineering	3	0	0	3
5.	PE	CSDX 305	Secure Software Development Life Cycle	3	0	0	3

SEMESTER - VI

1.	PE	CSDX 406	Social Media Security	3	0	0	3
2.	PE	CSDX 407	Cyber Crime Investigation and Digital Forensics	3	0	0	3
3.	PE	CSDX 408	Information Security Intelligence and Compliance Analytics Using Big Data	3	0	0	3
4.	PE	CSDX 409	Penetration Testing and Vulnerability Assessment	3	0	0	3
5.	PE	CSDX 410	Legal Issues in Information Assurance	3	0	0	3
6.	PE	CSDX 411	Secure Electronic Commerce	3	0	0	3
7.	PE	CSDX 412	Cloud Security	3	0	0	3

SEMESTER - VII

1.	PE	CSDX 306	Block Chain and Crypto Currency Technology	3	0	0	3
2.	PE	CSDX 307	Security in Industry 4.0	3	0	0	3
3.	PE	CSDX 308	Security Governance, Risk and Compliance	3	0	0	3
4.	PE	CSDX 309	Operating System Security	3	0	0	3
5.	PE	CSDX 310	Android Security	3	0	0	3
6.	PE	CSDX 311	Security in Smart Devices	3	0	0	3
7.	PE	CSDX 312	Cognitive Psychology in Cyber Security	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 Snd 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	GEDX201	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	IPRand 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

SEMESTER I

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 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.

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(phenylenevinylene), 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 JayadevSreedhar, 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) :
11thBoS 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	L	T	P	C
SDG: 4	CALCULUS	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   9+3
     VARIABLES

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

	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															

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",CharotarPublishing 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):   **Academic Council:**

18thBoS of MECH held on 21.06.2021   17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

SDG: 9

**MANUFACTURING PRACTICES
LABORATORY**

L	T	P	C
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 onsandmould preparation for simple components

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

COB5: To impart knowledge onDesign, assembly and testing ofelectronic 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

MECHANICAL 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 theconstruction and working of household appliances.

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

Board of Studies (BoS):   **Academic Council:**

18thBoS of MECH held on 21.06.2021   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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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   05
**   OPERATIONS**

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) :
18thBoS 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	PSO 1	PSO 2
CO1	-	M	L	H	-	L	-	-	M	-	-	-	-	-
CO2	H	M	M	-	-	H	M	-	M	-	-	-	-	-
CO3	H	M	H	-	-	H	-	-	H	-	-	-	-	-
CO4	H	H	H	H	M	H	-	-	H	-	-	-	-	-
CO5	H	H	H	H	H	H	H	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 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 Stephen 2011. 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 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.

MAD 1281   **ADVANCED CALCULUS**   **L**   **T**   **P**   **C**

SDG: 4   **3**   **1**   **0**   **4**

COURSE OBJECTIVES:

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

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

COB3: To learn 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	PO11	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 rigid bodies

COB3: To educate surface properties such as centroid and moment of inertia

COB4: To impart knowledge on friction and its applications

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

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	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.

| GED 1202 | **BASIC ELECTRICAL AND** | L | T | P | C |
| SDG: 3, 5, 8, 12 | **ELECTRONICS ENGINEERING** | 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   14
APPLICATIONS

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, SatyapratabaJit "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) :   **Academic Council:**

15th meeting of BoS of EEE held on   17th AC held on
25.06.2021   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	-	-	-
CO2	H	-	H	L	M	-	M	-	L	L	M	L	-	-	-
CO3	H	-	H	L	-	-	M	-	L	L	M	L	-	-	-
CO4	H	-	H	L	-	-	M	-	L	L	M	L	-	-	-
CO5	H	-	H	L	-	-	M	-	L	L	M	L	-	-	-

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	L	T	P	C
SDG: 8	PROGRAMMING	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   10
**   PROGRAMMING C++**

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: use the concepts of abstract class and polymorphism in programs.

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

CO4: perform Java programs using Packages, Multithreading and Exception handling

CO5: implement Object Oriented Programming for real time applications.

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

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	PSO2
CO1	H	M							M				H	H
CO2	H	M	M			M			M				H	H
CO3	H		M			M			M				H	H
CO4	H		M			M			M				H	H
CO5	H	H	H	H	M	H	H	L	H	L	H	H	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   8
               MANAGEMENT**

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   6
               ISSUES**

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. ErachBharucha, "Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education for University Grants Commission", Orient BlackswanPvt. 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

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

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 explore the fundamentals of python programming.
>
> **COB2:** To discover the need to work with control structures in Python programming.
>
> **COB3:** To learn objects, classes, and other object-oriented features
>
> **COB4:** To Illustrate the process of structuring data using lists, dictionaries, tuples and sets.
>
> **COB5:** To develop the ability to build real time applications.

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   9
                HANDLING**

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: Interpret the fundamental syntax and semantics of python program.

CO2: Demonstrate the use of Control flow structures in python program.

CO3: Discover methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.

CO4: Identify the commonly used operations involving file systems and packages.

CO5: Develop simple applications using Python programs.

Board of Studies (BoS) :	**Academic Council:**
19th BoS of CSE held on 28.12.2021	18th Academic council held on 24.02.2022

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

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 ofBoolean algebra and logic gates.

CO2:demonstrate the working mechanism and design guidelines of different combinational and sequential circuits.

CO3:evaluate the concepts of state and state transition for analysis and design

of sequential circuits.

CO4: Illustrate reduction of logical expressions using Boolean algebra and k-map.

CO5: implement digital logic circuits using logic gates.

Board of Studies (BoS):

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1					L									H
CO2		L												
CO3		H						M					M	
CO4													M	
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: 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. YashavantKanetkar," 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 application 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) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

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

COB2: To guide the importance of requirements gathering.

COB3: To represent the requirements collected using the various design models

COB4: To provide knowledge in developing software in a systematic method with quality.

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**   **10**
                             MAINTENANCE

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

	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					L									M
CO3			M							L				
CO4				M							L			
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 : 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 interpret the use of conditional statements, loops and function calls

COB2: To illustrate the application of regular expression in building the Python programs

COB3: To use functions for structuring Python programs.

COB4: To represent data using Python lists, tuples, dictionaries.

COB5: To discover the use of file system in Python.

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: explore the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data

CO2: implement Python programs with conditionals and loops.

CO3:develop Python programs step-wise by defining functions and calling them.

CO4: interpret the concepts of Object-oriented programming used in Python.

CO5:apply different algorithmic technique to solve classic problems.

Board of Studies (BoS) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	H													
CO2			M	L										
CO3								M					M	
CO4		L												
CO5													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 | L | T | P | C |
| SDG: 9 | LABORATORY | 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:identify the data structure to provide a solution for the given problem.

CO2:apply Stack and Queue ADT.

CO3:implement linear and non-linear data structure concepts through programming.

CO4:analyze the problem and identify the appropriate solution for it.

CO5:develop and implement the algorithm for the real time application.

Board of Studies (BoS) :

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	L													
CO2				M										
CO3							L							
CO4	H												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 :It 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2	PSO3
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	L	T	P	C
SDG: 9	NETWORKS	3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the basics and fundamental elements of network communications.

COB2: To study the various 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 kind of methods available in 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) :   **Academic Council:**

19th BoS of CSE held on   18th Academic council held on 24.02.2022
28.12.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H													
CO2		M												
CO3				M										
CO4			L											H
CO5				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 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   9
**   COMPLEXITY**

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)", Sound like your self Publishing ,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 divideandconquer.

CO4: apply the mathematical foundation in analysis of algorithms and develop new data structures by augmenting existing data structures and design algorithms that employ data structures.

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

Board of Studies (BoS) :   **Academic Council:**

19th BoS of CSE held on 28.12.2021   18th Academic council held on 24.02.2022

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

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 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 - Multi Threads - 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.

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:

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", 1st reprint, 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) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	H				L									
CO2				H	M									
CO3				H		M	M						H	
CO4						H	M							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 : 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 2231	COMPUTER AND INFORMATION	L	T	P	C
SDG: 9	SECURITY FUNDAMENTALS	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the Describe information security topics, terms, and concepts.

COB2: To understand the information security topics, terms, and concepts.

COB3: To learn the password security, encryptions, phishing, browser security, etc. and identify SPAM email messages.

COB4: To study the various security technologies, including anti-malware, firewalls, and intrusion detection systems.

COB5: To explore the physical security issues and how they support cyber security.

**MODULE I   OVERVIEW OF SYSTEM AND NETWORK   11
                    SECURITY**

Building a secure organization-A cryptography primer - Detecting system intrusions - Preventing system intrusions-guarding against network intrusions-securing cloud computing systems-securing web applications - Unix Linux security - Internet security-wireless security- wireless sensor security-optical security.

MODULE II   MANAGING INFORMATION SECURITY   8

Information security essentials - Online identity user management services - Intrusion detection and prevention systems - Vulnerability assessment-security metrics.

**MODULE III   CYBER,   NETWORK   AND   SYSTEMS   8
                   FORENSICS SECURITY AND ASSURANCE**

Cyber forensics-cyber forensics and incident response-securing e-discovery - Network forensics.

MODULE IV   ENCRYPTION TECHNOLOGY   9

Data encryption - Satellite encryption-public key infrastructure-password based authenticated key establishment protocols - Instant messaging security.

MODULE V   PRIVACY AND ACCESS MANAGEMENT   9

Privacy on the internet - Privacy enhancing technologies - Personal privacy policies - Virtual private networks - Identity theft - VoIP security.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. John R. Vacca, Computer and Information Security Handbook, Elsevier Science, 4th edition, Netherland, 2017.
2. Kizza, Joseph Migga. Guide to Computer Network Security, Springer International Publishing, Germany, 4th edition, 2017.

REFERENCES:

1. Pooch, Udo W., et al. Computer System and Network Security. United Kingdom, CRC Press, 4th edition 2017.

COURSE OUTCOMES:

CO1: Evaluate the computer security threats and countermeasures.

CO2: Apply the Principles of Least Privilege, Confidentiality, Integrity, and Availability.

CO3: Demonstrate knowledge of basic cryptographic principles, processes, procedures, and applications.

CO4: Construct network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).

CO5: Formulate information security governance, and related legal and regulatory issues.

Board of Studies (BoS) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th AC held on 24.02.2022

	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	M							
CO4							M	H							
CO5					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.

The holistic understanding of building materials and components leads to construction of resilient infrastructure and sustainable industrialization.

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

COURSE OBJECTIVES:

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

COB2: To model data base using Entity Relationship Diagrams and design database schemas based on the model.

COB3: To learn about relational database design and SQL commands.

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

COB5: To identify the threats to database security.

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   08
                    FORMS**

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   09
                    PROCESSING**

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. AviSilberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, ISBN 9780078022159, 7thEdition, 2019.
2. RamezElmasri, 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 fundamental elements of a relational database management system.
CO2:demonstrate any database applications using ER diagrams.
CO3: design databases using SQL queries for real time applications.
CO4:implement concurrency control and recovery mechanisms for practical problems.
CO5:apply security concepts to databases.

Board of Studies (BoS) :   **Academic Council:**
19th BoS of CSE held on 28.12.2021   18th Academic council held on
                                          24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	M	M				L						L	L	
CO2				M		M				L			M	H
CO3	H	M				M			L			L	M	
CO4	M			M		L	M							L
CO5	H			L		M	M			M			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 2232   **INFORMATION SECURITY LABORATORY**   L   T   P   C
SDG:9   0   0   2   1

COURSE OBJECTIVES :

COB1:   To study and implement simple security algorithm

COB2:   To understand the concept of public key encryption, its implementation and real time applications

COB3:   To know the symmetric algorithms, and its real time applications

COB4:   To identify the various applications of cryptography and security issues practically

COB5:   To analyze the different security parameters by installing the security tool kits

COB6:   Tofamiliar with S/MIME for e-mail communication

SOFTWARE REQUIRED : C/C++/JAVA

1.   Implement the Substitution and Transposition Techniques
2.   Implement DES
3.   Implement RSA and Diffie Hellman Algorithm
4.   Implement MD5 and SHA
5.   Implement Digital Signature Standard
6.   Install JCRYPT tool (or any other equivalent).   Demonstrate Symmetric and Asymmetric cryptographic algorithm, hash and digital signatures
7.   Demonstrate Intrusion Detection System (IDS) using any tool using SNORT (or any other equivalent)
8.   Demonstrate secure data storage, secure data transmission and create Digital Signatures GnuPG (or any other equivalent)
9.   Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
10. Install Rootkits and study the variety of options
11. Generate password hashes with OpenSSL.
12. Configuring S/MIME for e-mail communication
13. Using IPTABLES on Linux and setting the filtering rules
14. Understanding the buffer overflow and format string attacks
15. Setup a Honey pot and monitor the honey pot on network using KF Sensor (or any other equivalent)
16. Configure a firewall to block the following for 5 minutes and verify the correctness of this system using the configured parameters: (a)

Two neighborhood IP addresses on your LAN (b) All ICMP requests (c) All TCP SYN Packets

P-15; TOTAL HOURS-15

COURSE OUTCOMES :

Students who complete this course will be able to

CO1: implement Symmetric and asymmetric algorithms

CO2: install the different security toolkits and analyze various parameters

CO3: demonstrate Intrusion Detection System and Digital signatures using tool kits

CO4: generate password hashes with security toolkits

CO5: monitor flow of information in the network and look for vulnerability

CO6: configure the firewall to block the system and verify the correctness of the system

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

CSD 2207	DATABASE MANAGEMENT	L	T	P	C
SDG: 4	SYSTEMS LABORATORY	0	0	2	1

COURSE OBJECTIVES:

COB1: To describe the basics of SQL.

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

COB3: To implement real time applications of Database Management Systems.

COB4: To access and manipulate data using PL/SQL blocks.

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, 1st Edition, ISBN: 9781466687677, 2015.
3. ShashankTiwari, "Professional NoSQL", O'Reilly Media, 1st Edition, ISBN-13 : 978-0470942246, 2011.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: implement the DDL and DML commands.

CO2:write complex queries to solve the real world problems.

CO3: implement basic queries in NOSQL.

CO4: apply the basics of SQL and construct queries using SQL in database manipulation.

CO5 : design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.

Board of Studies (BoS) :

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	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		L												
CO3	H	H				M			L			L	M	
CO4														
CO5													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	L	T	P	C
SDG: 16	HUMAN RIGHTS	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 8
ABOUT INDIAN CONSTITUTION

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 7
DIRECTIVE PRINCIPLES

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

SDG: 8

WORKPLACE SKILLS AND APTITUDE FOR ENGINEERS

L	T	P	C
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.

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 prepare mathematical background for communication signal analysis.

COB3: To expose the working of different 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: analyze the different components and their respective roles in communication systems.

CO2: apply the performance objectives on the designed digital systems.

CO3: compare and contrast the different technologies applied to digital transmission systems.

CO4: select appropriate testing strategies employed in signal transmission.

CO5: identify the practical issues that impact reliable communication in real world scenarios.

Board of Studies (BoS) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	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	L	T	P	C
SDG: 9	NETWORK	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn about the challenges and opportunities with respect to cellular networks.

COB2: To provide knowledge on capacity and coverage analysis of relay node.

COB3: To describe the evolution of wireless networks standards such as IEEE 802.16, blue tooth and 3G.

COB4: To expose the students to have knowledge on UMTS.

COB5: To illustrate the 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:specify the opportunities and challenges with cellular networks.

CO2:analyze the capacity and coverage problem with multi hop relay.

CO3:acquire knowledge on wireless communication standards like WiFi, Bluetooth and 3G networks.

CO4:develop the working principles of wireless networks.

CO5: recognize the importance of CDMA 2000 and WiMax architecture.

Board of Studies (BoS) :   **Academic Council:**

19th BoS of CSE held on 28.12.2021   18th Academic council held on
                                                                    24.02.2022

	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 | L | T | P | C |
| SDG: 9 | SERVICES | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

COB1 : To expose multimedia services with real-time and non real-time components delivered over the Internet.

COB2 : To gain knowledge about various QoS and QoE measures for audio and video streams.

COB3 : To illustrate 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 provide 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   9
                NETWORK**

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, JaminSugih, 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:design new innovative network design for future.

Board of Studies (BoS) :	**Academic Council:**
19th BoS of CSE held on 28.12.2021	18th Academic council held on 24.02.2022

	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 study the basics in JavaScript programming.

COB2: To recognize the object models and event handling in JavaScript.

COB3: To practice embedded dynamic scripting on client side Internet Programming.

COB4: To expose the object oriented concepts and web security in PHP.

COB5: To provide the knowledge and ability to write computer scripts using PHP, a server-side scripting language to web to interact with and 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   9
                APPLICATION SECURITY

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, 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 basic 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) :   **Academic Council:**

19th BoS of CSE held on 28.12.2021   18th Academic council held on 24.02.2022

	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				
CO2									M					M
CO3	L									M				
CO4								M					L	
CO5	L							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 recall the basics of information retrieval with pertinence to modeling, query operations and indexing.

COB2: To introduce the information retrieval principles to locate relevant information on large collections of data.

COB3: To learn indexing methods for improving the performance of an information retrieval system.

COB4: To acquire knowledge on XML and text mining techniques.

COB5: To describe the various applications of information retrieval giving emphasis to multimedia IR, web search.

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   **MODELING**   **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:

CO1: Apply the concepts and techniques of Information Retrieval in various related fields.

CO2: Form the ontology for different domains and generate the equivalent representations.

CO3: Use different information retrieval techniques in various application areas

CO4 : Implement retrieval systems for web search tasks.

CO5: Apply document text mining techniques and analysis.

Board of Studies (BoS) :	**Academic Council:**
19th BoS of CSE held on 28.12.2021	18th Academic council held on 24.02.2022

	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 recognize the basics of event based programming using Adobe Flash Work with the timeline.

COB2: To comprehend the standards of Flex by which applications can be deployed consistently on all major browsers, desktops, and devices.

COB3: To gain knowledge on both client and server side scripting with Tween Animations

COB4: To identify with the Adobe Integrated Runtime Create 3D Effects.

COB5: To build interactive software as part of a development team (including artists, animators, designers, producers and/or other programmers).

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:evaluate and apply classes from a multimedia application programmer interface (API) or framework to aid the development of multimedia systems.

CO2:select appropriate methods for the storage, delivery and display of multimedia data.

CO3:develop object oriented programs to manipulate media objects.

CO4:apply programming techniques essential to the construction of multimedia systems.

CO5:communicate effectively (through the use of written material and visual presentations) to both technical and non-technical game developers.

Board of Studies (BoS) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	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 209	SOFTWARE DESIGN AND	L	T	P	C
SDG: 9	ARCHITECTURE	3	0	0	3

COURSE OBJECTIVES:

COB1: To provide an exposure 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 explain the role of various software architectures and styles.

COB5: To understand 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: Familiarize with the notion of software architectures, their importance, and identify the different types of architectures

CO2: Comprehend 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):	**Academic Council:**
19th BoS of CSE held on 28.12.2021	18th Academic council held on 24.02.2022

	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

Short Description. 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 learn the importance of integrity and control of system components throughout SDLC.

COB2: To analyze where the change happened in the history of a component development

COB3: To develop code in parallel with other developers and learn an environment focused on producing quality products.

COB4: To give an insight into the various risk levels in software development.

COB5: To provide 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 9
**   MONITORING**

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:recognize every configuration item of a software product

CO2:check the availability of the resource and support their team in the development process

CO3:identifyrisks associated with a project ,categorize risks and develop basic risk management skills.

CO4:develop a comprehensive risk management plan for a project.

CO5:qualitatively and quantitatively analyze risks and assess risks and apply the risk mitigation strategies.

Board of Studies (BoS) :

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1					L									
CO2			M											
CO3		H						M						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 : The students will be able to mitigate the challenges and risks faced in software industry.

CSDX 211	INFORMATION ETHICS AND	L	T	P	C
SDG: 4	VISUALIZATION	3	0	0	3

COURSE OBJECTIVES:

COB1: To understand importance of Ethics in Information and Computer Sciences.

COB2: To explore security issues over internet.

COB3: To characterize privacy, legal and ethical issues of information security.

COB4: To introduce the fundamental knowledge for Information Visualization

COB5: To construct and evaluate the interactive visualizations.

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   9
                        REPRESENTATION**

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: understand and apply ethical frameworks in information settings

CO2: articulate ethical conflicts in the information field

CO3: assess the interrelationship between individual privacy and the legal, regulatory, and technological challenges to privacy

CO4: design and build data visualization systems

CO5: evaluate information visualization systems and other forms of visual presentation for their effectiveness

Board of Studies (BoS) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO 2
CO1			L										L	
CO2	M	M											L	M
CO3	M		L		H								M	
CO4	M		L		H								L	
CO5	L	M											L	

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 expose basic programming in C# and the object-oriented programming concepts.

COB2: To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.

COB3: To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET.

COB4: To learn mobile applications using .Net compact framework.

COB5: To understand the working of base class libraries, their operations and manipulation of data using XML

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   9
**   MANIPULATION**

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   9
**   FRAMEWORK**

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 in C#.

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) :
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L												L		
CO2														M	
CO3		H	H						L	M	M		L	M	
CO4	L				L										
CO5	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 learner able to understand code solutions and compile C# projects within the .NET framework and to develop professional console and window based .NET application

CYBER SECURITY - ELECTIVES (SEMESTER IV)

CSDX 401	FUNDAMENTALS OF COMPUTER FORENSICS	L	T	P	C
		3	0	0	3

SDG: 9

COURSE OBJECTIVES:

    COB1: To inculcate the fundamentals of digital forensics from the viewpoint of courtroom legalities.

    COB2: To establish forensics concepts on networks and internet.

    COB3: To create digital forensics investigator role.

    COB4: To elaborate upon the evidence gathering over the internet.

    COB5: To gain the knowledge on digital investigations and search the current techniques for forensic examinations.

MODULE I   INTRODUCTION   9

Foundations of digital Forensics-Language of Computer Crime Investigation-Digital Evidence in the courtroom-Cybercrime law - Benefits of Professional Forensics Methodology

MODULE II   DIGITAL INVESTIGATIONS   9

Conducting Digital investigations-Handling a Digital Crime Scene-Investigative reconstruction with Digital Evidence-Modus Operandi motive and technology

MODULE III   CRIME AND DIGITAL EVIDENCE   9

Role of Computers in Violent Crime – Processing the digital Crime Scene-Investigative Reconstruction –Digital Evidence as Alibi – Investigating an Alibi – Time –Location as Alibi- Identifying and processing Digital evidence-Cyberstalking.

MODULE IV   COMPUTER BASICS FOR DIGITAL INVESTIGATIONS   9

Basic Operation of Computers –Representation of Data-Storage Media and Data Hiding-File Systems and Location of Data – Dealing with Password Protection and Encryption –Applying Forensic Science to Computers – Preparation –Survey – Documentation-Preservation-Examination and Analysis-Reconstruction and Reporting.

MODULE V   FORENSICS AND NETWORKS   9

Network basics for Digital Investigators-Network Technologies - Applying Forensic science to Networks- Digital Evidence on the internet- Evolution of 5G networks. Case Study - Email Forgery and Tracking – Mobile network Forensics - Forensics Tools.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet", Published by Elsevier, 3rd Edition, ISBN: 9780123742681, 2011.

REFERENCES:

2. Keith John Jones, Richard Bejtlich, Curtis W. Rose, "Real Digital Forensics: Computer Security and Incident Response", Addison Wesley Professional, 5th edition, ISBN: 9780321240699, 2008.

3. Terrence V. Lillard, Clint P. Garrison, "Digital Forensics for Network, Internet, and Cloud Computing: A Forensic evidence Guide for Moving Targets and Data", Elsevier, 1st Edition, ISBN: 9781597495370, 2010.

4. John Sammons, "The Basics of Digital Forensics, The Primer for Getting Started in Digital Forensics", 2nd Edition, Elsevier, ISBN: 9780128016350, 2014.

CO1: Recognize the role of digital forensics in the real world.

CO2: Identify and extract digital evidence from varied networking layers.

CO3: Apply forensics techniques for analyzing computer systems and networks.

CO4: Assess digital evidence and practice forensic investigation.

CO5: Describe the legalities, penalties, and punishment associated with cyber.

Board of Studies (BoS):

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	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	L														H
CO3					L									M	
CO4							L								
CO5						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 : Applying the forensics techniques for analyzing the computer systems in industry and suggest the legalities, penalties, and punishment associated with cyber.

CSDX402	OPEN SOURCE SOFTWARE AND	L	T	P	C
SDG: 9	OPEN STANDARDS	3	0	0	3

COURSE OBJECTIVES:

COB1: To learn open source standards and its evolution.

COB2: To explore on the various open source software.

COB3: To gain knowledge on LINUX basics and MySQL Database.

COB4: To expose the open sourceAndroid platform and PHP basics.

COB5: To get open source communities and development process.

MODULE I   INTRODUCTION TO STANDARDS AND EVOLUTION   09

Introduction to Standards - Types of Standards - Open and Closed Standard - Evolution of Standards - Life Cycle - Importance of Standards and Benefits of Open Standards - Standard Organizations - Examples of Open Standards adoption in the world.

MODULE II   LINUX BASICS   09

Need for Open Source Applications – Applications of Open Source Software - Kernel/User Mode – Process – Advanced Concept Scheduling – Cloning – Signals – Development with Linux – Open Source Software Installation.

MODULE III   ANDROID AND PHP BASICS   09

Open Source Android Platform – Android Architecture – Android Versions – Android sample App – PHP Introduction – Identifiers – Variables – Constants – Data Types – Operators – PHP Loops – Arrays – File Handling.

MODULE IV   MYSQL DATABASE   09

Installing/Configuring MySQL Database on LINUX and WINDOWS – Starting, Terminating and Writing Own SQL Programs – Record Selection Technology.

MODULE V   PYTHON   09

Python Basics – Data Types – Sets - Conditional Statements - Loops – Files – Input and Output Formatting - Errors and Exceptions – Functions – Modules .

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. M.N.Rao,"Fundaments of Open Source software",PHI Learning, ISBN : 9788120350120, 2014.
3.

REFERENCES:

1. Brian Fitzgerald, Jay P. Kesan, Barbara Russo, Maha Shaikh, Giancarlo Succi,"Adopting Open source software",MIT Press, ISBN : 9780262297349,2011.
2. Oliver Pelz," Fundamentals of Linux", Packt Publishing, ISBN: 9781789537529,2018.

COURSE OUTCOMES:

CO1: Trace the evolution of open source standards.

CO2: Implement open source applications using LINUX.

CO3: Create simple Open Source Android Platform and PHP

CO4: Develop MySQL Database on LINUX and Windows.

CO5: Ability to install and run open-source operating systems.

Board of Studies (BoS):	**Academic Council:**
19th BoS of CSE held on 28.12.2021	18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O 1	PSO 2
CO1	H				L									
CO2			H										H	
CO3								M						H
CO4			H	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

By learning this course, the student may be able to gain knowledge on LINUX basics and MySQL Database and in turn promote Industrial growth.

CSD X 403	**TCP/ IP**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

    COB1: To learn about basic networking concepts and services.

    COB2: To study the standards of TCP/IP protocols and addressing types.

    COB3: To learn the various protocol like ARP, RARP, UDP, ICMP and IGMP.

    COB4: To gain the knowledge on TCP, UDP protocols and connection management.

    COB5: To study the dataflow and window management system.

MODULE I	**INTRODUCTION AND THE INTERNET ADDRESS ARCHITECTURE**	**9**

Architectural Principles – Design and Implementation – Protocols of the TCP/IP suite – Internet, Intranet and Extranet – Designing Applications – Standardization Process – Implementation and Software Distributions – Attacks Involving the Internet Architecture. Expressing IP Address – Basic IP Address Structure – CIDR and Aggregation – Special-Use Address – Allocation – Unicast Address Assignment – Attacks Involving IP Address.

MODULE II   LINK LAYER   9

IEEE 802 LAN/MAN Standards – Full Duplex, Power Save Auto negotiation and 802.1X Flow Control – Bridges and Switches – Wireless LAN-IEEE 802.11 – Point-to-Point Protocol (PPP) – Loopback – MTU and Path MTU – Tunneling Basics – Attacks on the Link Layer.

MODULE III   ARP & IP   9

Direct Delivery and ARP – ARP Cache – Frame Format – Cache Timeout – Proxy ARP – Address Conflict Detection (ACD) – Embedded Devices IPv4 Address. IPv4 & IPv6 Headers – IPv6 Extension Headers – IP Forwarding – Mobile IP – Host Processing of IP Datagrams – Attacks Involving IP.

MODULE IV	**DNS & TCP – TRANSMISSION CONTROL PROTOCOL, CONNECTION MANAGEMENT**	**9**

DNS Name Spaces – Name Servers and Zones – Caching – DNS Protocol – Open DNS and DynDNS – Translating – DNS from IPv4 to IPv6. TCP Overview – TCP Header and Encapsulation – Connection Establishment and Termination – TCP Options – TCP State Transmissions – Reset Segments – TCP Server Operation – Attacks Involving TCP Connection Management.

MODULE V TCP TIMEOUT AND RETRANSMISSION – DATA FLOW AND WINDOW MANAGEMENT — 9

Simple Timeout – Retransmission Timeout – Timer Based Retransmission – Fast Retransmit – Retransmission with Selective Acknowledgements – Spurious Timeout and Retransmissions – Packet Reordering and Duplication – Destination Metrics – Repacketization. Interactive Communication – Delayed Acknowledgements – Nagle Algorithm – Flow Control and Window Management – Urgent Mechanism – Attacks Involving in Window Management.

L –45 ; TOTAL HOURS – 45

TEXTBOOKS:

1. Walter Goralski, "The Illustrated Network", Second Edition Morgan Kaufmann Publishing, 2017.

REFERENCES:

1. Behrouz A Forouzan, "TCP/IP Protocol suite", Tata McGrawHill, India, 2009.
2. Douglas E. Comer "Internetworking with TCP/IP", Pearson Education Sixth Edition, 2014.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, ISBN:9780133594140,2017.

COURSE OUTCOMES:

CO1: Recognize the computer network fundamentals and design principles.

CO2: Analyze the basic computer network protocol and link layer technologies.

CO3: Recognize the ARP, RARP, UDP, ICMP, IGMP protocols.

CO4: Memorize the User Datagram protocols in computer networks.

CO5: Analyze and interpret the effect of TCP timeout and Retransmission in networks.

Board of Studies (BoS):
19th BoS of CSE held on 28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2
CO1	L												L	
CO2		M											M	
CO3			M											M
CO4											M			M
CO5											H			M

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

SDG No: 9

Build the network terminology innovations and industrial development.

Statement: The holistic understanding of networkterminologies and components leads to construction of resilient infrastructure and sustainable industrialization.

CSD X 404   **SECURITY ARCHITECTURE**   **L   T   P   C**

SDG: 9   **3   0   0   3**

COURSE OBJECTIVES:

COB1: To gain an understanding of a well-designed cybersecurity architecture

COB2: To learn about the information security framework, including policies, controls, and procedures

COB3: Learn about the common exploits used to compromise identity

COB4: Learn how to apply secure coding best practices as a part of the Software Development Life Cycle.

COB5: Explore the purpose and use of common cybersecurity tools and technologies.

MODULE I   INTRODUCTION   09

Understanding the need for cybersecurity - What is cybersecurity architecture? - Architecture, security standards, and frameworks - Architecture roles and processes

MODULE II   BUILDING AN ARCHITECTURE   09

The Core of Solution Building - Establishing the context for designs - Understanding goals - Structures and documents - Risk management and compliance - Establishing a guiding process- Scope and Requirements - Understanding scope - Setting architectural scope - Scope – enterprise security - Scope – application security - The process for setting scope

MODULE III   BUILDING AN ARCHITECTURE – YOUR TOOLBOX   09

Introduction to the architect's toolbox - Planning tools - Building blocks of secure design

MODULE IV   BUILDING AN   ARCHITECTURE – DEVELOPING   09
**   ENTERPRISE BLUEPRINTS**

Requirements – Blueprints – Process - The vision - Creating a program - Documenting your high-level approach

MODULE V   BUILDING AN   ARCHITECTURE – APPLICATION   09
**   BLUEPRINTS**

Application design considerations - Life cycle models - Considerations for Waterfall projects - Considerations for Agile projects - Considerations for DevOps projects -

Process for application security design - Modifying the SDLC and development processes

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Moyle, Ed., Kelley, Diana. Practical Cybersecurity Architecture: A Guide to Creating and Implementing Robust Designs for Cybersecurity Architects. N.p.: Packt Publishing, 2020. ISBN:9781838982195, 1838982191

2. Ramachandran, Jay. Designing Security Architecture Solutions. India: Wiley India Pvt. Limited, 2002.ISBN:9788126502776, 8126502770

REFERENCES:

1. Schoenfield, Brook S. E..Securing Systems: Applied Security Architecture and Threat Models. United Kingdom: CRC Press, 2015.ISBN:9781482233988, 1482233983

COURSE OUTCOMES: Students who complete this course will be able to

CO1: Describe the importance of a well-designed cybersecurity architecture.

CO2: Explain the key components associated with security architecture and network design principles

CO3: Describe the processes associated with application security testing

CO4: Apply application security best practices while participating in the software development life cycle.

CO5: Make recommendations to implement compensating controls as part of a security architecture review.

Board of Studies (BoS):

19th BoS of CSE held on 28.12.2021

Academic Council:

18th Academic council held on 24.02.2022

	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											L	
CO2	L	L											L	
CO3	L	M	L	L	L			M						M
CO4	L	M	H	L	L				M	L		L		M
CO5	M	L	H	H	M				H	H	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 this course, the student may be able to create,a secured application and in turn promote Industrial growth and foster innovation.

| **CSCX 405** | **ROUTING AND SWITCHING** | **L** | **T** | **P** | **C** |

SDG: 8

<div align="right">

3   0   0   3

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COURSE OBJECTIVES:

COB1: Design and implement effective and efficient IP addressing.

COB2: To study Variable Length Subnet Mask (VLSM), Network Address Translation (NAT) and Dynamic Host Configuration Protocol (DHCP).

COB3: Work out a basic configuration of an IP router connecting a local network to the Internet.

COB4: Analyze, configure, implement, and verify access control lists within a router.

COB5: Configure and evaluate the major characteristics of the most used routing protocols within an autonomous system.

MODULE I   ESSENCE OF NETWORKS   7

The OSI reference model for data communications - TCP/IP-architecture for the Internet - Application and transport layer protocols - Internet Protocol IP addressing and subnetting - Local Area Networks (LAN) and Ethernet technology.

MODULE II   ROUTING   7

Managing the router as a core internetworking device - Basic router configuration – Routing - Path Determination algorithms - Routing Protocol RIP as distance-vector routing protocol. IP addressing with variable subnet mask (VLSM) beside some addressing methods like Dynamic IP configuration (DHCP) address translation (NAT).

MODULE III   SWITCHING ESSENTIALS   7

Switching Basics - Managing the LAN switch as a networking device - basic switch configuration - Spanning Tree protocol (STP) - Virtual LANs and frame-tagging - Routing between VLANs - Securing network devices using packet filters and firewall by applying access control lists (ACL).

MODULE IV   SCALING NETWORKS   7

Troubleshooting routers and switches - resolve common issues with using single-area OSPF - multiarea OSPF - Enhanced Interior Gateway Routing Protocol (EIGRP) - STP in both IPv4 - IPv6 networks

MODULE V   ATM AND CELLULAR WIRELESS NETWORKS   7

Introduction - ATM Frames - ATM Connection - ATM Architecture - Service Categories - PNNI Routing - PNNI Interface - PNNI Hierarchy - Building the Network Topology - Peer Group Leader - Advertizing Topology - Setting up Connection - Routing in Cellular Wireless Networks - Basics of Cellular Wireless Networks - Resource Allocation - Routing in GSM Networks - SNMP - Borderless networks.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. Comer D. E. "Internetworking with TCP/IP, Principles, Protocols and Architecture", 6th edition, Pearson Education.2013

REFERENCES:

2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education,2017.

3. Sudip Misra, Sumit Goswami, "Network Routing: Fundamentals, Applications, and Emerging Technologies", Wiley publication, ISBN: 978- 0-470-75006-3, 2017.

COURSE OUTCOMES:

CO1: Assess the fundamentals of network routing protocol.

CO2: Analyze the working of distance vector routing and link state routing protocol.

CO3: Discuss various characteristics of Internet routing protocols.

CO4: Classify the network topology of ATM and Cellular wireless networks.

CO5: Identify the issues in existing routing protocol and mobile routing protocols.

Board of Studies (BoS):
19th BoS of CSE held on
28.12.2021

Academic Council:
18th Academic council held on 24.02.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1					L								L	M
CO2	M	M			M			M			M		M	M
CO3		H			M			M			M	M	M	M
CO4					M			M			M	M	M	M
CO5			M		M			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 :Analysis and design network routing protocol provides sustainable economic growth and productive employment.

PHYSICS ELECTIVE

PHDX 01	NON DESTRUCTIVE TESTING OF MATERIALS	L	T	P	C
		2	0	0	2

SDG: 4

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, and 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) : **Academic Council:**

BOS of Physics was held on   17th AC held on 15.07.2021
21.6.21

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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
		2	0	0	2

SDG: 4

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   7 IMPERFECTIONS

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, and 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) :   **Academic Council:**

BOS of Physics was held on 21.6.21   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	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 6
**   SCREENING OF BIOMATERIALS**

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) :	**Academic Council:**
BOS of Physics was held on 21.6.21	17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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.

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PHDX 05   **SEMICONDUCTOR PHYSICS FOR**   L   T   P   C
                INFORMATION TECHNOLOGY   2   0   0   2

SDG: 4

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),magnetronsputtering,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).

CO2: gain insight into various fabrication techniques towards therealization of nano-dimensional semiconductor devices.

CO3: 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) :

BOS of Physics was held on 21.6.21

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	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.

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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 - electret microphone.

MODULE III SENSORS FABRICATION TECHNIQUES   7

Fabrication techniques – molecular beam epitaxy (MBE), chemical vapour deposition (CVD), pulsed laser deposition (PLD),magnetronsputtering,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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	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.

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PHDX 07	FUNDAMENTALS OF	L	T	P	C
SDG: 4	NANOTECHNOLOGY AND ITS APPLICATIONS	2	0	0	2

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, KamaliKannangara, 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) :	**Academic Council:**
BOS of Physics was held on 21.6.21	17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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.

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CHEMISTRY ELECTIVE

CHDX01

SDG: 9

CHEMISTRY OF CONSTRUCTION MATERIALS

L	T	P	C
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   7
                    RESEARCH**

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. WieslawKurdowski, 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) :

11th BoS 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 SDG: 9	CHEMISTRY OF MATERIALS AND ELECTROCHEMICAL DEVICES	L	T	P	C
		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, EkkehardDaschner "*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) :
11th BoS 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	-	-	-	-	-	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 | L | T | P | C |
| SDG: 9 | INSTRUMENTATION 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. AuliceScibioh, 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   7 SOLUTIONS

Characterization tools – UV-Visible (DRS), FT-IR, SEM, TEM, AFM, TG-DTA and XRD (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. AaftaabSethi, Khusbhoo Joshi, K. Sasikala and MallikaAlvala, Molecular Docking in Modern Drug Discovery: Principles and Recent Applications, IntechOpen, (2019), DOII: 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:

The students will be able to

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) :
15thBoS of Department of Chemistry held on 15.06.2021

Academic Council:
Mention Number and date
Ex: 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	-	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

SDG: 9

CHEMISTRY OF FUELS,
COMBUSTION AND LUBRICANTS

L	T	P	C
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:

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, EkkehardDaschner "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) :   **Academic Council:**

11th BoS of Chemistry held on   !7th AC held on 15.07.2021
17.06.2021

	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.

CHDX06   **INSTRUMENTAL METHODS OF**   **L**   **T**   **P**   **C**
                       POLYMER ANALYSIS

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 and X-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) :
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	-	-	-	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   8
**   DRUGS**

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. 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) :   **Academic Council:**

11thBoS of Chemistry held on 17.06.2021   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	-	-	-	-	-	-	-	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)

SSDX 01	ENGINEERING ECONOMICS	L	T	P	C
SDG: 4, 8, 9,12	AND MANAGEMENT	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, 1stEdition, 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	L	T	P	C
SDG: 17	TECHNOLOGY	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   9
AND CHANGE

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.

| **SSDX 03** | **INDUSTRIAL ECONOMICS AND** | **L** | **T** | **P** | **C** |
| **SDG: 8 and 9** | **MANAGEMENT** | **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:

7. Barthwal R R "Industrial Economics: An Introductory Textbook", New Age International Pvt. Ltd Publishers, 2017
8. 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) :
Mention details of 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	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) :
5th BoS 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	PO10	PO11	PO12
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

MADX01	TRANSFORMS AND PARTIAL	L	T	P	C
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) :

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														
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   9+3
FUNCTIONS

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   9+3
                     INTEGRATION

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   9+3
                     ORDINARY DIFFERENTIAL EQUATIONS

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) :	**Academic Council:**
12th BOS of Mathematics and AS department held 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	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