



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)*

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*B.Tech.  
(Computer Science and Engineering)*



**REGULATIONS 2021**  
**CURRICULUM AND SYLLABI (I - IV Semesters)**  
**(Amendments updated upto February 2022)**

**B.TECH. COMPUTER SCIENCE AND ENGINEERING**



## **VISION AND MISSION OF THE INSTITUTION**

### **VISION**

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

### **MISSION**

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



## **DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

### **VISION AND MISSION**

#### **VISION**

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

#### **MISSION**

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



**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, system software, multimedia, web design, big data analytics, networking and apply the knowledge to solve practical problems.

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

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

**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) of the 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 of the Institution who is responsible for the conduct of examinations and declaration of results.
- ix) **"Dean of the School"** means the Dean of the School of the department concerned.
- x) **"Head of the Department"** means the Head of the Department concerned.

**2.0 ADMISSION**

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

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

- 2.1b)** The student shall have studied at least any three of the following courses: Physics, Mathematics, Chemistry, Computer Science, Electronics, Information Technology, Biology, Informatics Practices, Biotechnology, Technical Vocational Subjects, Agriculture, Engineering Graphics, Business Studies, Entrepreneurship at 10+2 level. In case if the student has not studied any or all the courses viz., mathematics, physics and chemistry, he / she shall undergo bridge course(s) in the concerned course(s) at 10+2 level knowledge.
- 2.2** Notwithstanding the qualifying examination, the candidate might have passed at 10+2, the candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in the courses considered eligible for admission on the standards prescribed for 10+2 academic stream.
- 2.3** Candidates for admission to the third semester of the eight semester B.Tech.programme under lateral entry category shall be required to have passed minimum Three years / Two years (Lateral Entry) Diploma examination in any branch of Engineering / Technology or passed B.Sc. Degree from a recognized University as defined by UGC and passed 10+2 examination with Mathematics as a subject or Passed three year Diploma of Vocation Stream (D.Voc) in the same or allied sector or any other examination of any other authority accepted by the Institution as equivalent thereto.
- 2.4** The Institution shall offer suitable bridge courses in Mathematics, Physics, Engineering drawing, etc., for the students of diverse backgrounds.
- 2.5** The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution in adherence to the guidelines of regulatory authorities from time to time.

### **3.0 BRANCHES OF STUDY**

- 3.1** Regulations are applicable to the following B.Tech. Degree

programmes in various branches of Engineering and Technology, each distributed over eight semesters, with two semesters per academic year.

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

#### **4.0 STRUCTURE OF THE PROGRAMME**

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

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

##### **4.1.1 Mandatory Induction Programme for First year Students**

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

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

#### **4.1.2 Personality and Character Development**

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

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

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

#### **4.1.3 Online Courses for Credit Transfer**

Students are permitted to undergo department approved online courses under SWAYAM up to 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 sessions per week
- one credit for two periods of seminar / project work per week
- one credit for two weeks of industrial training or 80 hours per semester.

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

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

### **5.0 DURATION OF THE PROGRAMME**

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

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

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

## **6.0 REGISTRATION AND ENROLLMENT**

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

### **6.2 Change of a Course**

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

### **6.3 Withdrawal from a Course**

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

## **7.0 BREAK OF STUDY FROM PROGRAMME**

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

7.1.1 Medical or other valid grounds

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

7.1.3 Debarred due to any act of indiscipline

**7.2** The total duration for completion of the programme shall not exceed the prescribed 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 3<sup>rd</sup> to 8<sup>th</sup> 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 faculty concerned.

### **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 7<sup>th</sup> 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:

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

### **12.2 Theory Course**

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

### **12.3 Laboratory Course**

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

### **12.4 Laboratory Integrated Theory Courses**

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory

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

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

### **12.6 Industry Internship**

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

### **12.7 Project Work**

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

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

**12.9** For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards,

full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

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

### **13.0 SUBSTITUTE EXAMINATIONS**

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

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

### **14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION**

**14.1** 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 concerned department, 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:

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

**"W"** - denotes withdrawal from the course

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

**"U"** - denotes unsuccessful performance in the course.

- 16.2** A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.
- 16.3** Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further approve and declare the results.
- 16.4** Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.
- 16.5** After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

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

If  $C_i$ , is the number of credits assigned for the  $i^{\text{th}}$  course and  $GP_i$  is the Grade Point in the  $i^{\text{th}}$  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<br>Aeronautical Engineering  |
| 2.      | Block Chain                                  | Polymer Engineering   |
| 3.      | Cyber Security                               | Automobile Engineering  |
| 4.      | Data Science                                 | Civil Engineering   |
| 5.      | Internet of Things (IoT)                     | Biotechnology<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering  |
| 6.      | Virtual and Augmented Reality                | Mechanical Engineering<br>Aeronautical Engineering<br>Polymer Engineering<br>Automobile Engineering<br>Civil Engineering<br>Biotechnology<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering<br>Electronics and Communication Engineering |
| 7.      | Sensor Technology                            | Mechanical Engineering<br>Aeronautical Engineering<br>Polymer Engineering<br>Automobile Engineering<br>Civil Engineering<br>Biotechnology<br>Electrical and Electronics Engineering   |

|     |                       |   |
|-----|-----------------------|---|
| 8.  | Robotics              | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Civil Engineering<br>Biotechnology<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering                         |
| 9.  | 3D Printing           | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Biotechnology<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering<br>Electronics and Communication Engineering |
| 10. | Electric Vehicles     | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Civil Engineering<br>Biotechnology<br>Electronics and Communication Engineering   |
| 11. | Industrial Automation | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Mechanical Engineering<br>Aeronautical Engineering<br>Polymer Engineering<br>Automobile Engineering<br>Civil Engineering                            |

|     |                        |  |
|-----|------------------------|--|
|     |                        | Biotechnology<br>Electronics and Communication Engineering   |
| 12. | GIS and Remote Sensing | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Mechanical Engineering<br>Aeronautical Engineering<br>Polymer Engineering<br>Automobile Engineering<br>Biotechnology<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering<br>Electronics and Communication Engineering     |
| 13. | Computational Biology  | Artificial Intelligence and Data Science<br>Computer Science and Engineering (Cyber Security)<br>Computer Science and Engineering (IoT)<br>Computer Science and Engineering Information and Technology<br>Mechanical Engineering<br>Aeronautical Engineering<br>Polymer Engineering<br>Automobile Engineering<br>Civil Engineering<br>Electrical and Electronics Engineering<br>Electronics and Instrumentation Engineering<br>Electronics and Communication Engineering |

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

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

**21.0 POWER TO MODIFY**

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

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

**B.TECH. COMPUTER SCIENCE AND ENGINEERING**

**CURRICULUM & SYLLABI, REGULATIONS 2021**

*(Choice Based Credit System)*

**SEMESTER I**

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

**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 1202    | Basic Electrical and Electronics Engineering * | 3 | 0 | 2              | 4         |
| 6.      | ESC          | GED 1201    | Engineering Mechanics                          | 3 | 1 | 0              | 4         |
| 7.      | PCC          | CSD 1201    | Object Oriented Programming *                  | 2 | 0 | 2              | 3         |
| 8.      | MC           | GED 1206    | Environmental Sciences                         | 2 | 0 | 0              | 2         |
|         |              |             |  |   |   | <b>Credits</b> | <b>24</b> |

**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<br>Laboratory **              | 0 | 0 | 2 | 1         |
| 8.             | PCC          | CSD 2106    | Data Structures Laboratory **                    | 0 | 0 | 2 | 1         |
| 9.             | HSC          | GED 2101    | Essential Skills and Aptitude<br>for Engineers** | 0 | 0 | 2 | 1         |
| <b>Credits</b> |              |             |  |   |   |   | <b>23</b> |

**SEMESTER IV**

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

**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          | CSD 3102    | Artificial Intelligence and Machine Learning               | 3 | 0 | 0 | 3         |
| 3.             | PCC          | CSD 3103    | Network Security and Cryptography *                        | 3 | 0 | 2 | 4         |
| 4.             | PCC          | CSD 3104    | Data Mining and Data Warehousing                           | 3 | 0 | 0 | 3         |
| 5.             | PEC          |             | Professional Elective Courses                              |   |   |   | 6         |
| 6.             | PCC          | CSD 3105    | Internet and Web programming Laboratory **                 | 0 | 0 | 2 | 1         |
| 7.             | PCC          | CSD 3106    | Artificial Intelligence and Machine Learning Laboratory ** | 0 | 0 | 2 | 1         |
| 8.             | HSC          | GED 3101    | Communication Skills For Career Success**                  | 0 | 0 | 2 | 1         |
| 9.             | PROJ         | CSD 3107    | Internship I ##  | 0 | 0 | 0 | 1         |
| <b>Credits</b> |              |             |  |   |   |   | <b>23</b> |

**SEMESTER VI**

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



**SEMESTER VII**

| Sl. No.        | Course Group | Course Code | Course Title                  | L | T | P | C         |
|----------------|--------------|-------------|-------------------------------|---|---|---|-----------|
| 1.             | OEC          |             | Open Elective II              |   |   |   | 3         |
| 2.             | OEC          |             | Open Elective III             |   |   |   | 3         |
| 3.             | PCC          | CSD 4101    | Block Chain Technology        | 3 | 0 | 0 | 3         |
| 4.             | PEC          |             | Professional Elective Courses |   |   |   | 12        |
| 5.             | PROJ         | CSD 4102    | Internship II###              |   |   |   | 1         |
| 6.             | HSC          | GED 4202    | Employability Skills\$        | 0 | 0 | 2 | 1         |
| <b>Credits</b> |              |             |                               |   |   |   | <b>22</b> |

**SEMESTER VIII**

| Sl. No.        | Course Group | Course Code | Course Title | L | T | P  | C        |
|----------------|--------------|-------------|--------------|---|---|----|----------|
| 1.             | PROJ         | CSD 4201    | Project Work | 0 | 0 | 18 | 9        |
| <b>Credits</b> |              |             |              |   |   |    | <b>9</b> |

**Overall Total Credits – 167**

\* Laboratory Integrated Theory course

\*\* Laboratory Course

# Three Week Orientation Programme – Mandatory Non-Credit Course

## 15 days of Industrial training during the summer vacation of second year.

The credit will be awarded in the 5<sup>th</sup> Semester.

### 15 days of Industrial training during the summer vacation of third year.

The credit will be awarded in the 7<sup>th</sup> 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.

**LIST OF PROFESSIONAL ELECTIVE COURSES****SPECIALIZATION I: COMPUTER NETWORKS AND SECURITY****SEMESTER – IV**

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

**SEMESTER – V**

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

**SEMESTER – VI**

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

**SEMESTER – VII**

| Sl. No. | Course Group | Course Code | Course Title                                   | L | T | P | C |
|---------|--------------|-------------|--|---|---|---|---|
| 1.      | PEC          | CSDX 121    | Graph Theory and Application                   | 2 | 1 | 0 | 3 |
| 2.      | PEC          | CSDX 122    | Quantum Computing                              | 3 | 0 | 0 | 3 |
| 3.      | PEC          | CSDX 123    | Green Computing                                | 3 | 0 | 0 | 3 |
| 4.      | PEC          | CSDX 124    | Security Evaluation and Assessment Methodology | 3 | 0 | 0 | 3 |

|    |     |          |                                      |   |   |   |   |
|----|-----|----------|--------------------------------------|---|---|---|---|
| 5. | PEC | CSDX 125 | 5G Wireless Communication Techniques | 3 | 0 | 0 | 3 |
|----|-----|----------|--------------------------------------|---|---|---|---|

### SPECIALIZATION II: INTERNET PROGRAMMING AND SERVICES

#### SEMESTER – IV

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

#### SEMESTER – V

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

#### SEMESTER – VI

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

#### SEMESTER – VII

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

### SPECIALIZATION III: COMPUTER GRAPHICS AND MULTIMEDIA

#### SEMESTER – IV

| Sl. No. | Course Group | Course Code | Course Title              | L | T | P | C |
|---------|--------------|-------------|---------------------------|---|---|---|---|
| 1       | PEC          | CSDX 206    | Multimedia Design program | 3 | 0 | 0 | 3 |

|   |     |          |                                     |   |   |   |   |
|---|-----|----------|-------------------------------------|---|---|---|---|
| 2 | PEC | CSDX 207 | Sound Editing and processing        | 3 | 0 | 0 | 3 |
| 3 | PEC | CSDX 208 | Multimedia Application Development. | 3 | 0 | 0 | 3 |

**SEMESTER – V**

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

**SEMESTER – VI**

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

**SEMESTER – VII**

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

**SPECIALIZATION IV: SOFTWARE ENGINEERING**

**SEMESTER – IV**

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

**SEMESTER – V**

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

**SEMESTER – VI**

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

**SEMESTER – VII**

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

**SPECIALIZATION V: COMPUTER ARCHITECTURE AND APPLICATION ORIENTED COURSES****SEMESTER – IV**

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

**SEMESTER – V**

| Sl. No. | Course Group | Course Code | Course Title           | L | T | P | C |
|---------|--------------|-------------|------------------------|---|---|---|---|
| 1       | PEC          | CSDX 111    | Foundation on Robotics | 3 | 0 | 0 | 3 |

|   |     |          |  |   |   |   |   |
|---|-----|----------|--|---|---|---|---|
| 2 | PEC | CSDX 112 | Statistics and Analytics using R Programming | 2 | 0 | 2 | 3 |
| 3 | PEC | CSDX 113 | Essentials of Data Science                   | 3 | 0 | 0 | 3 |
| 4 | PEC | CSDX 114 | Theory of Computation                        | 3 | 0 | 0 | 3 |

#### SEMESTER – VI

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

#### SEMESTER – VII

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

**PHYSICS ELECTIVES – II Semester**

| <b>Sl. No.</b> | <b>Course Code</b> | <b>Course Title</b>                                 | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|----------------|--------------------|---|----------|----------|----------|----------|
| 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**

| <b>Sl. No.</b> | <b>Course Code</b> | <b>Course Title</b>  | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|----------------|--------------------|--|----------|----------|----------|----------|
| 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     | Probability and Statistics                    | 3 | 1 | 0 | 4 |
| 4       | MADX 04     | Random Processes                              | 3 | 1 | 0 | 4 |
| 5       | MADX 05     | Numerical Methods                             | 3 | 1 | 0 | 4 |

**HUMANITIES ELECTIVES – III Semester**

| Sl. No. | Course Code | Course Title                         | L | T | P | C |
|---------|-------------|--------------------------------------|---|---|---|---|
| 1       | SSDX 01     | Engineering Economics and Management | 3 | 0 | 0 | 3 |
| 2       | SSDX 02     | Sociology of Science and Technology  | 3 | 0 | 0 | 3 |
| 3       | SSDX 03     | Industrial Economics and Management  | 3 | 0 | 0 | 3 |
| 4       | SSDX 04     | Dynamics of Indian Social Structure  | 3 | 0 | 0 | 3 |

**HUMANITIES ELECTIVES – VI Semester**

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



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

| Sl. No. | Course Code | Course Title                                      | L | T | P | C | Offering Department |
|---------|-------------|---|---|---|---|---|---------------------|
| 1       | 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                 |

| B.Tech. | Computer Science and Engineering |   |   |   | Regulations 2021 |   |          |
|---------|----------------------------------|---|---|---|------------------|---|----------|
| 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                 |

| B.Tech. | Computer Science and Engineering |  |   |   | Regulations 2021 |   |            |
|---------|----------------------------------|--|---|---|------------------|---|------------|
| 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**

|                 |                            |          |          |          |          |
|-----------------|----------------------------|----------|----------|----------|----------|
| <b>PHD 1182</b> | <b>ENGINEERING PHYSICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>   |                            | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**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 and apply it to understand ideas of quantum computing.

**CO3:** Grasp ideas related to oscillations, interference phenomenon, apply it to understand optical based devices and classify the different laser systems used for various applications.

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

**CO5:** Understand the principles of physics behind semiconductors, Hall effect and apply the same to identify type of any semiconductor sample, evaluate no. of charge carriers.

**Board of Studies (BoS) :**

BOS of Physics was held on 21.06.21

**Academic Council:**

17<sup>th</sup> 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.

|                 |                                     |          |          |          |          |
|-----------------|-------------------------------------|----------|----------|----------|----------|
| <b>CHD 1182</b> | <b>CHEMISTRY FOR ELECTRICAL AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>ELECTRONIC ENGINEERING</b>       | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**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.

|                 |                                    |           |
|-----------------|------------------------------------|-----------|
| <b>MODULE I</b> | <b>POLYMERS FOR ELECTRICAL AND</b> | <b>10</b> |
|                 | <b>ELECTRONIC APPLICATIONS</b>     |           |

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

|                  |                      |           |
|------------------|----------------------|-----------|
| <b>MODULE II</b> | <b>NANOMATERIALS</b> | <b>10</b> |
|------------------|----------------------|-----------|

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<sub>2</sub>O), electrodeposition (semiconductor materials), precipitation (Ag, Au), thermolysis: solvothermal (CuO, CeO<sub>2</sub>) and hydrothermal (TiO<sub>2</sub>, ZnO, carbon dots), microwave method (metal oxide), biogenic method – nanocomposite.

|                   |                  |          |
|-------------------|------------------|----------|
| <b>MODULE III</b> | <b>BATTERIES</b> | <b>8</b> |
|-------------------|------------------|----------|

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.

|                  |                       |          |
|------------------|-----------------------|----------|
| <b>MODULE IV</b> | <b>PHOTOCHEMISTRY</b> | <b>9</b> |
|------------------|-----------------------|----------|



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, electroless plating of PCB, coatings : paints: constituents and function – hot dipping – galvanizing, tinning – powder coating – anodising – special coatings: water repellent coatings, fire-retardant coatings, temperature indicating coatings.

### **PRACTICALS**

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

**L –45; P – 30; Total Hours –75**

### **TEXT BOOKS:**

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

### **REFERENCES:**

1. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1986.
2. Michael L. Berins, Plastics Engineering Hand Book, 5<sup>th</sup> 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) :

11<sup>th</sup> BoS of Chemistry held on 17.06.2021

### Academic Council:

15<sup>th</sup> 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.



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, 5<sup>th</sup> 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) :**

12<sup>th</sup> BOS of Mathematics & AS held on  
23.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

|                 |                             |          |          |          |          |
|-----------------|-----------------------------|----------|----------|----------|----------|
| <b>GED 1101</b> | <b>ENGINEERING GRAPHICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                             | <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

**COURSE OBJECTIVES:**

**COB1:** To introduce the basic concepts of engineering drawing, and familiarize 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 be conversant with 3D isometric projection, and perspective projection of simple solids.

**COB5:** To introduce computerized drafting using CADD for drawing the orthographic views of simple solids.

|                 |  |             |
|-----------------|--|-------------|
| <b>MODULE I</b> | <b>BASICS, ENGINEERING CURVES AND</b>        | <b>L: 7</b> |
|                 | <b>ORTHOGRAPHIC PROJECTION OF POINTS AND</b> | <b>P: 7</b> |
|                 | <b>STRAIGHT LINES</b>                        |             |

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.

|                  |  |             |
|------------------|--|-------------|
| <b>MODULE II</b> | <b>PROJECTION OF PLANES AND SOLIDS</b> | <b>L: 7</b> |
|                  |  | <b>P: 7</b> |

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

|                   |   |            |
|-------------------|---|------------|
| <b>MODULE III</b> | <b>SECTION OF SOLIDS AND DEVELOPMENT OF</b> | <b>L:5</b> |
|                   | <b>SURFACES</b>                             | <b>P:5</b> |

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

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

**MODULE IV THREE DIMENSIONAL PROJECTIONS****L:4****P: 4**

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

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

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

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

**L – 30;P – 30;Total Hours – 60****TEXT BOOKS:**

1. N.D. Bhatt, "Engineering Drawing", Charotar Publishing house, 53<sup>rd</sup> Edition, 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, 31<sup>st</sup> 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 draw conic sections, special curves and orthographic projection of points and straight 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):**

18<sup>th</sup>BoS of MECH held on 21.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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



|                 |                           |          |          |          |          |
|-----------------|---------------------------|----------|----------|----------|----------|
| <b>GED 1102</b> | <b>ENGINEERING DESIGN</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG:9</b>    |                           | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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", 4<sup>th</sup> 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):

18<sup>th</sup>BoS of MECH held on 21.06.2021

### Academic Council:

17<sup>th</sup> 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.

|                 |                                |          |          |          |          |
|-----------------|--------------------------------|----------|----------|----------|----------|
| <b>GED 1103</b> | <b>MANUFACTURING PRACTICES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>LABORATORY</b>              | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**COURSE OBJECTIVES:**

**COB1:** To learn the basics of pipe connections used in household and industrial systems

**COB2:** To educate the usage of welding equipment's and machining methods

**COB3:** To impart knowledge on sand mould preparation for simple components

**COB4:** To explore various tools, instruments and methods used in electrical wiring

**COB5:** To impart knowledge on Design, assembly and testing of electronic circuits

**PRACTICALS**

List of Experiments:

**CIVIL ENGINEERING PRACTICE:**

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

**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, 5<sup>th</sup> Edition, 2019.

**REFERENCES:**

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

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:** demonstrate Plumbing requirements of domestic buildings.

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

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

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

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

**Board of Studies (BoS):**

18<sup>th</sup>BoS of MECH held on 21.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 |
|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|------|------|
| CO1 | M    | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -     | -    | -    |
| CO2 | H    | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -     | -    | -    |
| CO3 | M    | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -     | -    | -    |
| CO4 | L    | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -     | -    | -    |
| CO5 | L    | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -     | -    | -    |

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

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

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

|                 |                        |          |          |          |          |
|-----------------|------------------------|----------|----------|----------|----------|
| <b>GED 1104</b> | <b>PROGRAMMING FOR</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8</b>   | <b>PROBLEM SOLVING</b> | <b>1</b> | <b>0</b> | <b>2</b> | <b>2</b> |

**COURSE OBJECTIVES:**

**COB1:** To explore the hardware and software components of the computer

**COB2:** To learn the structured and procedural programming concepts using C.

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

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

**COB5:** To understand pointer and file operation concepts.

**MODULE I INTRODUCTION TO C PROGRAMMING 05**

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

**MODULE II DECISION MAKING AND ARRAY 05**

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

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

Definition of Functions - Function Types – Nesting of Functions – Recursion – Structures and Unions – Pointers - File handling 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) :**

18<sup>th</sup> BoS of CSE held on 26.07.2021

**Academic Council:**

17<sup>th</sup> 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**

|                 |                              |          |          |          |          |
|-----------------|------------------------------|----------|----------|----------|----------|
| <b>END 1181</b> | <b>ENGLISH FOR ENGINEERS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>   |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

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

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

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

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

**COB5:**To sharpen their academic writing skills

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

**MODULE I HUMAN RESOURCES 10**

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

S: Introducing one self – exchanging personal info.

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

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

Voc. development: Prefixes, Suffixes

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

**MODULE II TRANSPORT 10**

L: Listening to long scientific talks

S: Sharing personal information – greeting, leave taking.

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

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

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

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

**MODULE III ENERGY 9**

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

S: Asking about routine actions & expressing opinions.

R: Locating Specific Information

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

Voc. development: Sequence words, misspelt words.

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

**MODULE IV OUR LIVING ENVIRONMENT 8**

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

S: Speaking about one's friend.

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

W: Argumentative writing.

Voc. Development: Synonyms, antonyms, phrasal verbs.

Lang. development: If clauses, Subject - Verb Agreement

**MODULE V TECHNOLOGY 8**

L: Listening to talks (General & Scientific).

S: Short group conversations.

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

W: Short essays, Dialogue writing.

Voc. Development: Idioms & Phrases.

Lang. development: Modal verbs.

**L - 45; Total Hours -45**

**TEXT BOOKS:**

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

**REFERENCES:**

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

### COURSE OUTCOMES:

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

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

**CO3:**Comprehend conversations and short talks delivered in English

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

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

### Board of Studies (BoS) :

13<sup>th</sup>BoS of Department of English held on 17.6.2021

### Academic Council:

17<sup>th</sup> AC held on 15.07.2021

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

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

SDG 4 : Give Quality Education to all the Engineers

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

|                |                          |          |          |          |          |
|----------------|--------------------------|----------|----------|----------|----------|
| <b>MAD1281</b> | <b>ADVANCED CALCULUS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  |                          | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**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, 5<sup>th</sup> 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) :**

12<sup>th</sup> BOS of Mathematics & AS held on  
23.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO<br>10 | PO1<br>1 | PO<br>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

|                 |                              |          |          |          |          |
|-----------------|------------------------------|----------|----------|----------|----------|
| <b>GED 1201</b> | <b>ENGINEERING MECHANICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                              | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**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, 10<sup>th</sup> Edition, 2017.
2. R.K. Bansal., “A Text Book of Engineering Mechanics”, Laxmi Publications, 6<sup>th</sup> Edition, 2015.

**REFERENCES:**

1. Russell C Hibbeler, “Engineering Mechanics: Statics & Dynamics”, 14<sup>th</sup> Edition, Pearson, 2015.
2. Irving H. Shames, “Engineering Mechanics – Statics and Dynamics”, 4<sup>th</sup> Edition, Pearson Education India, 2005.
3. R.S. Khurmi., “A Text Book of Engineering Mechanics”, S. Chand Publishing, 22<sup>nd</sup> 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):**18<sup>th</sup> BOS held on 21.06.2021**Academic Council:**17<sup>th</sup> AC held on 15.07.2021



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

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

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

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

|                         |                                |          |          |          |          |
|-------------------------|--------------------------------|----------|----------|----------|----------|
| <b>GED 1202</b>         | <b>BASIC ELECTRICAL AND</b>    | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 3, 5, 8, 12</b> | <b>ELECTRONICS ENGINEERING</b> | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**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 on basic 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 of voltage, current and power in DC circuits.

**MODULE II AC CIRCUITS & MEASUREMENTS 17**

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

**MODULE III ELECTRICAL MACHINES 18**

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

(Qualitative treatment only).

**MODULE IV SEMICONDUCTOR DEVICES AND APPLICATIONS 14**

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

Bipolar Junction Transistor and 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/A Conversion – Data acquisition systems

### **PRACTICALS**

#### **List of Experiments**

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

**L – 45; P – 30; Total Hours – 75**

#### **REFERENCES:**

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

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

**COURSE OUTCOMES:**

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

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

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

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

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

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

**Board of Studies (BoS) :**

15th meeting of BoS of EEE held on  
25.06.2021

**Academic Council:**

17<sup>th</sup> AC held on  
15.07.2021

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

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

SDG 3: Good health and well being.

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

SDG 5: Gender equality

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

SDG 8: Decent work and economic

Statement: The learners of this course can get decent 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 in reasonable consumption and production.

|                 |                        |          |          |          |          |
|-----------------|------------------------|----------|----------|----------|----------|
| <b>CSD 1201</b> | <b>OBJECT ORIENTED</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8</b>   | <b>PROGRAMMING</b>     | <b>2</b> | <b>0</b> | <b>2</b> | <b>3</b> |

**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) :**

18<sup>th</sup> BoS of CSE held on 26.07.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO1 | 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.



|                 |                               |          |          |          |          |
|-----------------|-------------------------------|----------|----------|----------|----------|
| <b>GED 1206</b> | <b>ENVIRONMENTAL SCIENCES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: All</b> |                               | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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 spots of biodiversity and Red Data book - Threats to biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**MODULE III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 8**

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

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

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

Case studies related to current situation.

**L – 30; Total Hours - 30**

**TEXT BOOKS:**

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

**REFERENCES:**

1. Masters G.M., "Introduction to Environmental Engineering and Science", Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., "Environmental Science and Engineering", Prentice Hall International Inc., New Jersey, 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.cg.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) :**

11<sup>th</sup> BoS of Chem held on  
17.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| CO 1 | -    | L    | M    | -    | -    | L    | M    | -    | -    | -     | -     | -     | -     | -     | -     |
| CO 2 | -    | -    | -    | M    | H    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     |
| CO 3 | -    | -    | -    | -    | -    | -    | M    | M    | -    | -     | L     | -     | M     | -     | -     |
| CO 4 | -    | -    | -    | -    | -    | M    | M    | M    | -    | -     | -     | L     | -     | -     | -     |
| CO 5 | -    | -    | -    | -    | -    | -    | -    | -    | -    | -     | -     | -     | -     | -     | -     |

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

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

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

**SEMESTER III**

|                 |                           |          |          |          |          |
|-----------------|---------------------------|----------|----------|----------|----------|
| <b>CSD 2101</b> | <b>PYTHON PROGRAMMING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 HANDLING 9**

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

**L –45; TOTAL HOURS – 45**

**TEXT BOOKS:**

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

**REFERENCES:**

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

19<sup>th</sup> 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   |     |     |     |     |      |      |      |      |      |
| 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 able to apply the concepts to design real time application which can improve productive employment.

|                 |                        |          |          |          |          |
|-----------------|------------------------|----------|----------|----------|----------|
| <b>CSD 2102</b> | <b>DIGITAL SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                        | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**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.

|                 |  |          |
|-----------------|--|----------|
| <b>MODULE I</b> | <b>BOOLEAN ALGEBRA AND LOGIC GATES</b> | <b>9</b> |
|-----------------|--|----------|

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.

|                  |                            |          |
|------------------|----------------------------|----------|
| <b>MODULE II</b> | <b>COMBINATIONAL LOGIC</b> | <b>9</b> |
|------------------|----------------------------|----------|

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

|                   |                                     |          |
|-------------------|-------------------------------------|----------|
| <b>MODULE III</b> | <b>SYNCHRONOUS SEQUENTIAL LOGIC</b> | <b>9</b> |
|-------------------|-------------------------------------|----------|

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

|                  |                               |          |
|------------------|-------------------------------|----------|
| <b>MODULE IV</b> | <b>REGISTERS AND COUNTERS</b> | <b>9</b> |
|------------------|-------------------------------|----------|

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

|                 |   |          |
|-----------------|---|----------|
| <b>MODULE V</b> | <b>MEMORIES AND REGISTER TRANSFER LOGIC</b> | <b>9</b> |
|-----------------|---|----------|

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, 1<sup>st</sup> edition, ISBN-13:9781316632932,2018.

### REFERENCES:

- 1 S K Mandal, "Digital Electronics: Principles and Applications", McGraw Hill Education, 1<sup>st</sup> edition, ISBN-10: 0070153825, 2017.
- 2 Kumar A. Anand, "Fundamentals of Digital Circuits", PHI, 4<sup>th</sup> 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, 6<sup>th</sup> edition, ISBN-10:9353062012, 2018.

### COURSE OUTCOMES:

After completion of the course, students should be able to

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

**CO2:** 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) :**

19<sup>th</sup> 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   |     |     |     |     |      |      |      |      | 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 able to apply the concepts to build real time projects which can add to productive employment.

|                 |                        |          |          |          |          |
|-----------------|------------------------|----------|----------|----------|----------|
| <b>CSD 2103</b> | <b>DATA STRUCTURES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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, 5<sup>th</sup> edition, ISBN-13:978-9381068588, 2018.

**REFERENCES:**

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

19<sup>th</sup> 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 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 |
|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| 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 able to apply the data structures to solve real time problems which can improve the productive employment.

|                 |                             |          |          |          |          |
|-----------------|-----------------------------|----------|----------|----------|----------|
| <b>CSD 2104</b> | <b>SOFTWARE ENGINEERING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 MAINTENANCE 10**

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

Engineering – Risk Management.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**COURSE OUTCOMES:**

After completion of the course, students should be able to

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

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

**CO3:** design frameworks for the application to be developed

**CO4:** ensure that the software satisfies the quality standards

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

**Board of Studies (BoS) :**

19<sup>th</sup> 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.



|                 |                           |          |          |          |          |
|-----------------|---------------------------|----------|----------|----------|----------|
| <b>CSD 2105</b> | <b>PYTHON PROGRAMMING</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>LABORATORY</b>         | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**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) :**

19<sup>th</sup> 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.

|                 |                        |          |          |          |          |
|-----------------|------------------------|----------|----------|----------|----------|
| <b>CSD 2106</b> | <b>DATA STRUCTURES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>LABORATORY</b>      | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**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) :**

19<sup>th</sup> 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.

|                 |                                      |          |          |          |          |
|-----------------|--------------------------------------|----------|----------|----------|----------|
| <b>GED 2101</b> | <b>ESSENTIAL SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 17</b>  | <b>FOR ENGINEERS</b>                 | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**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) :

13<sup>th</sup>BoS of the Department of  
English held on 17.6.2021

### Academic Council:

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

**SEMESTER IV**

|                 |                               |          |          |          |          |
|-----------------|-------------------------------|----------|----------|----------|----------|
| <b>CSD 2201</b> | <b>COMPUTER COMMUNICATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>AND NETWORKS</b>           | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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, 5<sup>th</sup> 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”, 5<sup>th</sup> 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) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18th Academic council held on  
24.02.2022

|     | PO1 | PO2 | PO3 | PO4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO1 1 | PO 12 | PSO 1 | PSO 2 |
|-----|-----|-----|-----|-----|------|------|------|------|------|-------|-------|-------|-------|-------|
| CO1 | H   |     |     |     |      |      |      |      |      |       |       |       |       |       |
| 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.

|                 |                               |          |          |          |          |
|-----------------|-------------------------------|----------|----------|----------|----------|
| <b>CSD 2202</b> | <b>ANALYSIS OF ALGORITHMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8</b>   |                               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

**COB1:** To learn the asymptotic performance of algorithms.

**COB2:** To acquire knowledge on principles of algorithm design.

**COB3:** To become familiar with divide and conquer techniques.

**COB4:** To study the different algorithmic design strategies.

**COB5:** To explore the significance of NP-completeness.

**MODULE I INTRODUCTION 9**

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

**MODULE II BRUTE FORCE 9**

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

**MODULE III DIVIDE AND CONQUER 9**

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

**MODULE IV DYNAMIC PROGRAMMING AND COMPUTATIONAL COMPLEXITY 9**

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

**MODULE V NP-COMPLETE AND NP-HARD PROBLEM 9**

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes – Decision Trees – PNP and NP Complete Problems – Challenges of Numerical Algorithms – Backtracking – Branch and Bound – Approximation

Algorithms for NP Hard Problems – Algorithms for Solving Non Linear Equations - External-Memory Algorithms - Parallel Algorithms.

**L –45 ; TOTAL HOURS – 45**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**COURSE OUTCOMES:**

After completion of the course, students should be able to

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

**CO2:**apply design principles and concepts to algorithm design.

**CO3:** implement algorithms using the 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) :**

19<sup>th</sup> 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    |      |
| CO2 |     |     |     | H   |     |     |     |     |     |      |      |      |      |      |
| CO3 |     |     |     | M   |     |     |     |     |     |      |      |      |      | M    |
| CO4 |     |     |     |     | M   |     |     |     |     | M    |      |      |      |      |
| CO5 |     | L   |     |     |     |     |     |     |     | L    |      |      |      |      |

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

SDG No. & Short Description

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.

|                 |                                  |          |          |          |          |
|-----------------|----------------------------------|----------|----------|----------|----------|
| <b>CSD 2203</b> | <b>COMPUTER ARCHITECTURE AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>MICROPROCESSOR</b>            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

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

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

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

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

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

**MODULE I BASIC STRUCTURE OF COMPUTERS 09**

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

**MODULE II PROCESSOR STRUCTURE AND FUNCTION 09**

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

**MODULE III MEMORY AND I/O 09**

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

**MODULE IV BASICS OF MICROPROCESSOR 09**

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

**MODULE V 8086 SYSTEM BUS STRUCTURE 09**

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

**L – 45; TOTAL HOURS –45**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:**apply the working of central processing unit and its applications.

**CO2:**develop the essentials of the working of the computing units and trace the operation.

**CO3:**identify the various elements of 8085 microprocessor architecture, its bus organization including control signals.

**CO4:**implement 8086 family Assembly Language Programming.

**CO5:**analyze the microcontroller basics and showcase its applications.

**Board of Studies (BoS) :**

19<sup>th</sup> 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 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|------|------|
| CO1 | L   |     | H   |     |     | M   |     |     |     |       |       | L     | L    |      |
| CO2 |     |     |     | L   |     |     |     |     |     | L     |       |       |      | H    |
| CO3 | L   |     |     |     |     | M   |     |     | L   |       |       | L     |      |      |
| CO4 |     |     | H   |     |     | H   |     |     |     |       |       |       |      | L    |
| CO5 |     |     |     |     |     |     | H   |     |     | M     |       |       | M    |      |

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

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

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



|                 |                          |          |          |          |          |
|-----------------|--------------------------|----------|----------|----------|----------|
| <b>CSD 2204</b> | <b>OPERATING SYSTEMS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                          | <b>3</b> | <b>0</b> | <b>2</b> | <b>4</b> |

**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.

**L – 45 ; P – 30; TOTAL HOURS – 75**

**PRACTICALS****LIST OF EXPERIMENTS**

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

**L –45 ; P - 30:TOTAL HOURS –75**

**TEXT BOOKS:**

1. Abraham SilberSchatz, Peter B Galvin, Greg Gagne, "Operating System Concepts", 9<sup>th</sup> edition, John Wiley & Sons Inc, ISBN:978-1-118- 06333-0, 2013.
2. Deitel H M, "Operating Systems", 3<sup>rd</sup> edition, Pearson education India, New Delhi, ISBN: 978-0-536-21215-3, 2007.
3. Dhamdhare D M, "Operating Systems", 1<sup>st</sup>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) :**

19<sup>th</sup> 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 | 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.

|                 |                            |          |          |          |          |
|-----------------|----------------------------|----------|----------|----------|----------|
| <b>CSD 2205</b> | <b>DATABASE MANAGEMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>SYSTEMS</b>             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 FORMS 08**

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

**MODULE IV QUERY OPTIMIZATION AND TRANSACTION PROCESSING 09**

Query Processing - Syntax Analyzer - Query Decomposition and Optimization - Cost Estimation in Query Optimization -Pipelining and Materialization - Structure

of Query Evaluation Plans - Transaction Processing and Concurrency Control - Transaction Concepts - Concurrency Control - Locking Methods for Concurrency Control.

## **MODULE V RECOVERY AND SECURITY 09**

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

**L – 45; TOTAL HOURS –45**

### **TEXT BOOKS:**

1. AviSilberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, ISBN 9780078022159, 7<sup>th</sup>Edition, 2019.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7<sup>th</sup> 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, 8<sup>th</sup> edition, ISBN-13: 978-0321197849, 2006.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3<sup>rd</sup> edition, McGraw-Hill, ISBN: 978-9339213114, 2014.

### **COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:** 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) :**

19<sup>th</sup> 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 | 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.

|                 |                                |          |          |          |          |
|-----------------|--------------------------------|----------|----------|----------|----------|
| <b>CSD 2206</b> | <b>COMPUTER COMMUNICATION</b>  | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>AND NETWORKS LABORATORY</b> | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**COURSE OBJECTIVES:**

**COB1:** To expose networking concepts using simple programs.

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

**COB3:** To emulate client server architecture using different protocols.

**COB4:** To demonstrate the error handling mechanisms in networks.

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

**PRACTICALS**

List of Experiments:

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

**P – 30; TOTAL HOURS – 30**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**COURSE OUTCOMES:**

After completion of the course, students should be able to

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

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

**CO3:**build error check and control mechanisms in communication.

**CO4:**develop simple security mechanisms in the networking applications.

**CO5:** build real time application using client server architecture.

**Board of Studies (BoS) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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   |     |       |      |       |      |      |
| CO5 |     |     |     |     |     |     |     |     |     |       |      |       | 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 : Exposing to Networking concepts provides security solutions for industrial applications within the networking environment.



|                 |                            |          |          |          |          |
|-----------------|----------------------------|----------|----------|----------|----------|
| <b>CSD 2207</b> | <b>DATABASE MANAGEMENT</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>   | <b>SYSTEMS LABORATORY</b>  | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**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, 4<sup>th</sup> 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, 1<sup>st</sup>Edition, ISBN: 9781466687677, 2015.
3. ShashankTiwari, “Professional NoSQL”, O’Reilly Media, 1<sup>st</sup>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) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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.

|                 |                                |          |          |          |          |
|-----------------|--------------------------------|----------|----------|----------|----------|
| <b>GED 2202</b> | <b>INDIAN CONSTITUTION AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 16</b>  | <b>HUMAN RIGHTS</b>            | <b>2</b> | <b>0</b> | <b>0</b> | <b>0</b> |

**COURSE OBJECTIVES:**

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

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

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

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

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

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

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

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

**MODULE III GOVERNANCE IN INDIA 8**

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

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

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

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

**L – 30; TOTAL HOURS –30**

**TEXT BOOKS:**

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

**REFERENCES:**

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

**COURSE OUTCOMES:** At the end of the course, the students will be able to

**CO1:** describe the emergence and evolution of Indian Constitution.

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

**CO3:** compare the various structure of Indian government.

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

**Board of Studies (BoS) :**

4<sup>th</sup>BoS of SSSH held on 28.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

|                 |                                      |          |          |          |          |
|-----------------|--------------------------------------|----------|----------|----------|----------|
| <b>GED 2201</b> | <b>WORKPLACE SKILLS AND APTITUDE</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8</b>   | <b>FOR ENGINEERS</b>                 | <b>0</b> | <b>0</b> | <b>2</b> | <b>1</b> |

**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) :**

13<sup>th</sup>BoS of the Department of English  
held on 17.6.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS O1 | PSO2 | PS O3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|------|-------|
| 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**

|                 |                             |          |          |          |          |
|-----------------|-----------------------------|----------|----------|----------|----------|
| <b>CSDX 201</b> | <b>DIGITAL TRANSMISSION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                             | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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.

|                 |  |           |
|-----------------|--|-----------|
| <b>MODULE I</b> | <b>BASIC TERMINOLOGIES AND BASEBAND TRANSMISSION</b> | <b>11</b> |
|-----------------|--|-----------|

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.

|                  |                             |           |
|------------------|-----------------------------|-----------|
| <b>MODULE II</b> | <b>DIGITAL TRANSMISSION</b> | <b>09</b> |
|------------------|-----------------------------|-----------|

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.

|                   |                        |           |
|-------------------|------------------------|-----------|
| <b>MODULE III</b> | <b>DIGITAL SYSTEMS</b> | <b>10</b> |
|-------------------|------------------------|-----------|

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.

|                  |   |           |
|------------------|---|-----------|
| <b>MODULE IV</b> | <b>NETWORK TIMING AND SYNCHRONIZATION</b> | <b>08</b> |
|------------------|---|-----------|

Time Standards – Frequency Sources – Clocks – Synchronization Techniques – Dissemination Systems: Time, Frequency – Synchronization Schemes – Transmission System – Testing Techniques.

|                 |                               |           |
|-----------------|-------------------------------|-----------|
| <b>MODULE V</b> | <b>MONITORING AND CONTROL</b> | <b>07</b> |
|-----------------|-------------------------------|-----------|

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) :**

19<sup>th</sup> 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.

|                 |                              |          |          |          |          |
|-----------------|------------------------------|----------|----------|----------|----------|
| <b>CSDX 202</b> | <b>CELLULAR AND WIRELESS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>NETWORK</b>               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 NETWORK CHALLENGES 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) :**

19<sup>th</sup> 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   |     | 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).

|                 |                                   |          |          |          |          |
|-----------------|-----------------------------------|----------|----------|----------|----------|
| <b>CSDX 203</b> | <b>DESIGN OF COMPUTER NETWORK</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>SERVICES</b>                   | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 NETWORK 9**

Connection-oriented networks - MPLS architecture - DiffServ architecture - MPLS support for DiffServ - Label distribution protocol - Resource reservation protocol- The resource reservation protocol-traffic engineering (RSVP-TE).

**MODULE V NEW NETWORK DESIGN 9**

New IP: Enabling next wave of networking innovation – Collaborative network

towards application aware networking- Content delivery networks – Green for ICT, Green by ICT , Green by Design.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Harry Perros, Networking Services QoS, Signaling, Processes, Create space Independent Publications, ISBN: 1495437485, 978-1-49-543748-9, 2014.
2. Christian Jacquenet, "Design Innovation and Network Architecture for the Future Internet", ISBN: 9781799876472, Engineering Science Reference, 2021.

**REFERENCES:**

1. Peterson, Larry L., and Bruce S. Davie, Computer networks: a systems approach, Elsevier, ISBN:978-0-12-374013-7, 2012.
2. Jin, Cheng, Jamin Sugih, Danny Raz, and Yuval Shavitt, Building scalable network services: theory and practice, Springer Science & Business Media, ISBN: 978-1-44-198897-3, 2011.

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:** identify the attributes that impact the network services.

**CO2:** assess the QoS and QoE measures of audio and video streams.

**CO3:** summarize the functionalities of IP multimedia subsystem.

**CO4:** compare the different QoS architecture along with their protocols.

**CO5:** design new innovative network design for future.

**Board of Studies (BoS) :**

19<sup>th</sup> 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   | 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.

|                 |                            |          |          |          |          |
|-----------------|----------------------------|----------|----------|----------|----------|
| <b>CSDX 204</b> | <b>SCRIPTING LANGUAGES</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 APPLICATION SECURITY 9**

Object Oriented PHP-Error and exception handling-Form processing and business logic-Reading from a database-Cookies-Dynamic content-Web

application security risks-Building a secure web application-Implementing authentication methods with PHP. Interacting with file system and server-network and protocol functions-Session control-Integrating java script and PHP

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition,London, ISBN:9780072253573, 2013.
2. Harvey Deitel, Paul Deitel, Abbey Deitel,“Internet and World Wide Web How To Program”, fifth edition, Pearson Education, ISBN: 13:978-0-273-76402-1, 2012.

**REFERENCES:**

1. David Flanagan, “JavaScript: The Definitive Guide”, Sixth Edition,O'Reilly Media, ISBN: 978-0-596-80552-4, 2012.
2. Luke Welling, Laura Thomson,“ PHP and MySQL Web Development”, fifth edition, Addison Wesley, ISBN: ISBN 13: 9780321833891, 2016.

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:**implement 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) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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.

|                 |                              |          |          |          |          |
|-----------------|------------------------------|----------|----------|----------|----------|
| <b>CSDX 205</b> | <b>INFORMATION RETRIEVAL</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                              | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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.

|                 |                                  |          |          |          |          |
|-----------------|----------------------------------|----------|----------|----------|----------|
| <b>CSDX 206</b> | <b>MULTIMEDIA DESIGN PROGRAM</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG:9</b>    |                                  | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 Play a 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 - Work 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) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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

|                 |                          |          |          |          |          |
|-----------------|--------------------------|----------|----------|----------|----------|
| <b>CSDX 207</b> | <b>SOUND EDITING AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>PROCESSING</b>        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

**COB1:** To gain knowledge about existing technologies of sound and editing.

**COB2:** To learn various speech and audio technologies.

**COB3:** To explore the basic concepts of digital audio and speech.

**COB4:** To elaborate on scientific principles and audio signal processing.

**COB5:** To understand the acoustic perception and digital reproduction process.

**MODULE I INTRODUCTION TO SOUND AND SPEECH 9**

Basic audio processing - Normalization - Continuous audio processing - Visualization - Sound generation - The human voice - characteristics of speech – types of speech.

**MODULE II BASIC AUDIO PROCESSING 9**

Sound in MATLAB - Normalization - Continuous audio processing- Segmentation - Analysis window sizing - Visualization - Sound generation.

**MODULE III THE HUMAN VOICE AND AUDITORY SYSTEM 9**

Speech production - Characteristics of speech - Types of speech - Speech understanding - Physical processes - Perception - Amplitude and frequency models.

**MODULE IV PSYCHOACOUSTICS AND COMMUNICATIONS 9**

Psychoacoustic processing - Auditory scene analysis - Psychoacoustic modeling - Hermansky - style model - MFCC model - Masking effect of speech - Quantization - Parameterization - Pitch models - Analysis- Perceptual weighting.

**MODULE V STUDIO ACOUSTICS AND DIGITAL AUDIO TECHNOLOGY 9**

The Basics of Sound - Waveform Characteristic - Auditory Perception - Studio Types - Frequency Balance - Acoustic Echo Chambers - Power- and Ground-Related Issues - The Basics of Digital Audio - Digital Reproduction Process - Digital Audio Recording Systems - Hard Disk Recording.

**L – 45 ; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Ian Vince McLoughlin "Speech and Audio Processing: A MATLAB based Approach", Cambridge University Press, First edition, USA, ISBN: 1107085462, 2016.
2. David Miles Huber, Robert E. Runstein, "Modern Recording Techniques (Audio Engineering Society Presents), Focal Press, Eighth edition, USA, ISBN-13: 978-0240821573, 2013.
3. Michael Talbot-Smith "Sound Engineering Explained", Focal Press, Second edition, USA, ISBN: 0240516672, 2012.

**REFERENCES:**

1. Wallace Jackson, "Digital Audio Editing Fundamentals", Apress publisher, First Edition, Lompoc, California, USA, ISBN-13 : 978-1-4842-1647-7, 2015.
2. Nelson Morgan Ben Gold, "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", Willey publication, Second Edition, USA, ISBN-13 : 978-8126508228, 2006.
3. <http://eemedia.ee.unsw.edu.au/contents/elec9344/LectureNotes/>
4. <https://www.bridgeacademy.in/training/Sound-Engineering-Course.php>.

**COURSE OUTCOMES:**

**CO1:** Analyze and apply the basic concepts of audio theory and musical acoustics

**CO2:** Examine and interpret the specifications of audio recording

**CO3:** Ensure the audio recordings by using audio workstations

**CO4:** Recognize the importance of psychoacoustics

**CO5:** Improve the sound acoustics and demonstrate basic video recording skills.

**Board of Studies (BoS) :**

19<sup>th</sup> 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    |      | M    |      |       |       |       |       | M     |
| CO2 |      |      |      |      |      |      | M    |      |      |       |       |       |       |       |
| CO3 |      |      |      |      |      |      |      |      |      |       |       |       | M     |       |
| CO4 |      |      |      |      |      |      | M    |      |      |       |       |       |       |       |
| CO5 |      |      |      |      | H    |      |      | L    |      |       |       |       |       | H     |

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

SDG 9: Construct flexible Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The elite virtual infrastructure could be attained with the advanced sound editing technology.

|                 |                               |          |          |          |          |
|-----------------|-------------------------------|----------|----------|----------|----------|
| <b>CSDX 208</b> | <b>MULTIMEDIA APPLICATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8</b>   | <b>DEVELOPMENT</b>            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**COURSE OBJECTIVES:**

**COB1:**To learn the components for building the multimedia blocks.

**COB2:**To provide the basic concepts of multimedia elements.

**COB3:**To represent the functions of the multimedia skill in the software industry.

**COB4:**To understand the multimedia development mechanism for particular applications.

**COB5:**To learn the application structure for the given real time scenario.

**MODULE I FUNDAMENTAL CONCEPTS 09**

Multimedia and hypermedia, world wide web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video. Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

**MODULE II ACTIONSCRIPT 09**

ActionScript Features, Object-Oriented ActionScript, Datatypes and Type Checking, Classes, Authoring an ActionScript Class - Inheritance, Authoring an ActionScript 2.0 Subclass, Interfaces, Packages, Exceptions.

**MODULE III APPLICATION DEVELOPMENT 09**

An OOP Application Frame work, Using Components with ActionScript MovieClip Subclasses.

**MODULE IV MULTIMEDIA DATA COMPRESSION 09**

Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression, Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zero tree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT)- Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

**MODULE V MULTIMEDIA NETWORKS 09**

Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand(MOD).

**L – 45; TOTAL HOURS – 45****TEXT BOOKS:**

1. Drew, Mark S., Liu, Jiangchuan., Li, Ze-Nian. Fundamentals of Multimedia. Germany: Springer International Publishing, ISBN:9783319052908,2014.
2. Havaldar, Parag., Medioni, Gerard. Multimedia Systems: Algorithms, Standards, and Industry Practices. Italy: Cengage Learning, ISBN:9781418835941,2009.

**REFERENCES:**

1. Colin Moock, Essential ActionScript 3.0, 1st Edition, SPD O'Reilly, ISBN: 978-0-596-52694-8, 2007.

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:** identify the components for building the multimedia blocks.

**CO2:** use and produce the multimedia elements.

**CO3:** classify the function of the multimedia skill in the software industry.

**CO4:** choose an appropriate multimedia development mechanism for particular applications.

**CO5:** develop the application structure for the given real time scenario.

**Board of Studies (BoS) :**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

18<sup>th</sup> 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 | L    |      |      |      |      |      |      |      |      |       |       |       | M     |       |
| CO3 |      | M    |      |      |      |      |      |      |      |       |       |       |       | M     |
| CO4 |      |      | H    |      |      |      |      |      |      |       |       |       |       |       |
| CO5 |      |      | H    |      | M    |      |      |      |      |       |       |       |       | H     |

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

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

Statement: By learning this course, the student may be able to create and transform multimedia application and in turn promote Industrial growth and foster innovation.

|                 |                            |          |          |          |          |
|-----------------|----------------------------|----------|----------|----------|----------|
| <b>CSDX 209</b> | <b>SOFTWARE DESIGN AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>ARCHITECTURE</b>        | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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):**

19<sup>th</sup> BoS of CSE held on 28.12.2021

**Academic Council:**

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24.02.2022

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|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| CO1 |      |      | M    | H    |      |      |      |      |      |       |       |       |       |       |
| CO2 |      |      |      | H    |      |      | M    |      |      |       |       |       |       |       |
| CO3 |      |      |      |      | H    |      | L    |      |      |       |       |       |       | M     |
| CO4 | M    |      |      | H    |      |      |      |      |      |       |       | L     | H     |       |
| CO5 | M    |      |      |      | H    | L    |      |      |      |       |       |       |       |       |

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

**SDG No. 9**

Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The comprehensive understanding of different software design and architecture concepts, criteria, attributes and design patterns provides way for the development of innovative software that may suit the needs of the industry and society.

|                 |                                   |          |          |          |          |
|-----------------|-----------------------------------|----------|----------|----------|----------|
| <b>CSDX 210</b> | <b>SOFTWARE CONFIGURATION AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   | <b>RISK MANAGEMENT</b>            | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 INTRODUCTION 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 paradigm-cultural considerations.

**MODULE V RISK ASSESSMENT, MITIGATION AND MONITORING 9**

Discovering risks-Methods-classification of risks-risk taxonomy-reviews-Risk assessment approaches-tools and techniques- risk planning-risk mitigation strategies- formulating and implementing risk management plans-risk databasemanaging and tracing risk.

**L – 45; TOTAL HOURS – 45****TEXT BOOKS:**

1. Alexis Leon, "Software Configuration Management Handbook", Artech House, Third Edition, ISBN 978-1-60807-843-1, 2015.
2. John McManus, "Risk Management in Software Development Projects", Route Ledge, ISBN: 1136367918, 9781136367915 ,2012.

**REFERENCES:**

1. Maria E Moriera, "Software Configuration Management Implementation Roadmap", John Wiley & Sons , ISBN 0-470-86264-5, 2004.
2. 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:** Identify risks 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):**

19<sup>th</sup> BoS of CSE held on  
28.12.2021

**Academic Council:**

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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.

|                 |                               |          |          |          |          |
|-----------------|-------------------------------|----------|----------|----------|----------|
| <b>CSDX 211</b> | <b>INFORMATION ETHICS AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>   | <b>VISUALIZATION</b>          | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 REPRESENTATION 9**

Creating Visual Representation – Reference Model – Designing a Visual Application – Visual representation of Linear data – 2D vs 3D – Evaluating Visual Representations – Analytic Methods – Empirical Methods.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. George W. Reynolds, "Ethics in Information Technology", Cengage Learning, 6th Edition, ISBN-13: 978-1337405874, 2019.
2. Riccardo Mazza, "Introduction to Information Visualization", Springer, ISBN: 978-1-84800-219-7, 2009.

**REFERENCES:**

1. Toni Samek and Lynette Shultz, "Information Ethics Globalization and Citizenship", McFarland & Company, (ISBN: 9781476667720), 2017.
2. Colin Ware, "Information Visualization: Perception for Design", Morgan Kaufmann, an imprint of Elsevier, Third edition, (ISBN:978-0123814647), 2012.
3. Robert Spence, "Information Visualization: Design for Interaction", Pearson Publishers, Second Edition, (ISBN: 978-0132065504, 2007.
4. Andreas Kerren, John Stasko, Jean-Daniel Fekete and Chris North, "Information Visualization: Human-Centered Issues and Perspectives", Springer Edition, ISBN:978-3540709558, 2008.

**COURSE OUTCOMES:**

After completion of the course, students should be able to

**CO1:**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) :**

19<sup>th</sup> 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



|                 |                    |          |          |          |          |
|-----------------|--------------------|----------|----------|----------|----------|
| <b>CSDX 212</b> | <b>C# AND .NET</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>   |                    | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 MANIPULATION 9**

Diagnostics -Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML- SAX and DOM – Manipulating files and the Registry- Transactions – ADO.NET- Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation.

**MODULE IV WINDOW BASED APPLICATIONS, WCF AND WWF 9**

Window based applications – Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services – .Net Remoting – Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows

**MODULE V .NET FRAMEWORK AND .NET COMPACT FRAMEWORK 9**

Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunneling Events- Reading and Writing

XAML - .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner- Professional C# 2012 and .NET 4.5, Wiley, ISBN -13: 978-1118314425, 2012.
2. Harsh Bhasin, —Programming in C#, Oxford University Press, ISBN-13 : 978-0198097402, 2014.

**REFERENCES:**

1. IanGariffiths, Mathew Adams, Jesse Liberty, Programming C# 4.0, OReilly, Fourth Edition, ISBN: 9780596159832, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, ISBN: 978-1-4302-4234-5, 2012.

**COURSE OUTCOMES:**

**CO1:**Demonstrate the knowledge of object-oriented concepts

**CO2:**Implement string manipulation, events and exception handling within .NET application environment.

**CO3:**Develop and manipulate GUI components 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) :**

19<sup>th</sup> 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 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO1 1 | PO 12 | 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

**PHYSICS ELECTIVE**

|                |                                   |          |          |          |          |
|----------------|-----------------------------------|----------|----------|----------|----------|
| <b>PHDX 01</b> | <b>NON DESTRUCTIVE TESTING OF</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  | <b>MATERIALS</b>                  | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE OBJECTIVES:**

**COB1:**To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

**COB2:**To study the working and instrumentation of thermography and eddy current testing methods and apply to interpret the results and investigate the possible defects.

**COB3:**To get full exposure about principle, instrumentation and standards of various radiographic NDT methods and improve the skill to identify the defects suitably.

**COB4:**To get deep insight into the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT methods.

**COB5:**To understand the importance, principle, concept and inspection methods of various surface NDT methods and develop the skills of interpretation of results effectively.

**MODULE I SURFACE NDT METHODS 7**

Liquid Penetrant Inspection – Principles, Types of dye and methods of application, developers, advantages and limitations of various methods, Interpretation of results. Magnetic Particle Inspection- Magnetic particle testing, Basic theory of magnetism, Magnetization methods, Interpretation of field indicators, Particle application, Inspection, Residual magnetism Principles and methods of demagnetization.

**MODULE II THERMOGRAPHY AND EDDY CURRENT TESTING 7**

Thermography- Principles, Contact and non contact inspection methods, Advantages and limitation – infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Applications, advantages, Limitations, Interpretation/Evaluation.

**MODULE III RADIOGRAPHY 8**

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse

square law, characteristics of films -graininess, density, speed, contrast, characteristic curves. Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography.

#### **MODULE IV      ULTRASONIC TESTING**

**8**

Ultrasonic Testing: Basic principles of sound propagation, types of sound waves, Principle of UT, methods of UT, their advantages and limitations, Piezoelectric Material, Various types of transducers/probe, Calibration methods, use of standard blocks, technique for normal beam inspection.

**L – 30; Total Hours –30**

#### **TEXT BOOKS:**

1. ASM Metals Handbook, Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, 200, 2018.
2. Baldev Raj, T.Jayakumar, M.Thavasimuthu Practical Non-Destructive Testing, Narosa Publishing House, 2014.

#### **REFERENCES:**

1. Ravi Prakash, Non-Destructive Testing Techniques, 1st revised edition, New Age International Publishers, 2010.
2. Paul E Mix, Introduction to Non-destructive testing: a training guide, Wiley, 2nd Edition New Jersey, 2005.
3. Charles, J. Hellier, Handbook of Nondestructive evaluation, McGraw Hill, New York 2001.
4. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).

#### **COURSE OUTCOMES:**

**CO1:** Demonstrate the importance, principle, concept and inspection methods of various surface NDT methods and apply the same to interpret the results effectively.

**CO2:** Comprehend the ideas behind working of thermography and eddy current testing methods and apply them to interpret the results of testing and analyse the defects and problem.

**CO3:** Grasp the fundamental principles and standards of various radiographic NDT methods and utilise them to identify the defects and defect location suitably.

**CO4:** Assimilate the ideas concerning the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT

methods and identify the areas for their application.

**Board of Studies (BoS) :**

BOS of Physics was held on  
21.6.21

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>PHDX 02</b> | <b>MATERIALS SCIENCE FOR</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  | <b>ENGINEERING</b>           | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE OBJECTIVES:**

**COB1:** To impart knowledge on the fundamentals of materials science and engineering.

**COB2:** To provide a basis for understanding properties and applications of dielectric materials.

**COB3:** To expose the students to different classes of materials, their properties, structures and imperfections

**COB4:** To aid the teaching learning process through relevant illustrations, animations, web content and practical examples

**MODULE I CLASSIFICATION OF MATERIALS 6**

Concept of amorphous, single crystals and polycrystalline materials, crystallinity and its effect on physical properties, metal, ceramic, polymers, classification of polymers, structure and properties, additives for polymer products, effect of environment on materials, composites

**MODULE II PROPERTIES OF MATERIALS 10**

Mechanical Properties: Stress-strain response of metallic, ceramic and polymer materials, yield strength, tensile strength and modulus of elasticity, toughness, plastic deformation, fatigue, creep and fracture- Electronic Properties: Free electron theory, Fermi energy, density of states, band theory of solids, semiconductors, Hall effect, dielectric behaviour, piezo, ferro, pyroelectric materials - Magnetic Properties: Origin of magnetism in metallic and ceramic materials, para-magnetism, diamagnetism, ferro and ferrimagnetism- Thermal Properties: Specific heat, thermal conductivity and thermal expansion, thermoelectricity- Optical Properties: Refractive index, absorption and transmission of electromagnetic radiation in solids, electro-optic and magneto-optic materials.

**MODULE III CRYSTALLOGRAPHIC STRUCTURES AND IMPERFECTIONS 7**

Crystal symmetry, point groups, space groups, indices of planes, close packing in solids, bonding in materials, coordination and radius ratio concepts, point defects, dislocations, grain boundaries, surface energy and equilibrium shapes of crystals.

**MODULE IV THERMODYNAMICS AND KINETICS****7**

Phase rule, phase diagrams, solid solutions, invariant reactions, lever rule, basic heat treatment of metals, solidification and phase transformations, Fick's laws of diffusion, mechanisms of diffusion, temperature dependence of diffusivity.

**L – 30; Total Hours –30****TEXT BOOKS:**

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

**REFERENCES:**

1. William D. Callister, Jr., David G. Rethwisch, Materials Science and Engineering, Edition 9, Wiley, 2014.
2. Michael F. Ashby, David R.H. Jones , Engineering Materials 1 An Introduction to Properties, Applications and Design · Volume 1, Elsevier Science, 2012
3. Michael F. Ashby, David R.H. Jones , Engineering Materials 2: An Introduction to Microstructures, Processing and Design · Volume 2, Elsevier Science, 2013
4. Reza Abbaschian, Robert E. Reed-Hill, Physical Metallurgy Principles - SI Version, Cengage Learning, NY, 2009
5. "Encyclopedia of Polymer Science and Technology" 3<sup>rd</sup> Edition, Vol.1-12, Wiley Interscience , 2003

**COURSE OUTCOMES**

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

**CO1:**select suitable material for specific application.

**CO2:** analyse crystallographic structure of metals and their imperfections.

**CO3:** develop metal alloys with varying properties by selecting suitable heat treatment

**CO4:** correlate the various properties of material with their structure.

**Board of Studies (BoS) :**

BOS of Physics was held on 21.6.21

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021



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

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

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

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

|                |                     |          |          |          |          |
|----------------|---------------------|----------|----------|----------|----------|
| <b>PHDX 03</b> | <b>BIOMATERIALS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  |                     | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE OBJECTIVES:**

**COB1:**To gain basic knowledge in classification of biomaterials and their properties.

**COB2:**To provide a basis for understanding properties of metallic implant materials.

**COB3:**To enable the students to correlate theoretical principles with practical applications.

**COB4:**To help students understand biocompatibility & toxicological screening of biomaterials

**MODULE I INTRODUCTION TO BIOMATERIALS 8**

Introduction: Definition of biomaterials, requirements & classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Surface properties of materials, physical properties of materials, mechanical properties-Materials for biophotonic applications.

**MODULE II IMPLANT MATERIALS 10**

Metallic implants: Stainless steels, Co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion-ceramic implants : bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics-Polymer implants: Polymerization, factors influencing the properties of polymers, polymers as biomaterials, biodegradable polymers, Bio polymers: Collagen, Elastin and chitin.

**MODULE III BIOCOMPATIBILITY AND TOXICOLOGICAL SCREENING OF BIOMATERIALS 6**

Definition of biocompatibility, blood compatibility and tissue compatibility. Toxicity tests: acute and chronic toxicity studies (in situ-implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test), sensitization, carcinogenicity, mutagenicity and special tests.

**MODULE IV PRACTICAL ASPECTS OF BIOMATERIALS 6**

Preparation of biomaterials - Microscopic study & analysis of different biomaterials- alginate – material preparation and characterization - Testing of various biomaterials- case studies on industrial and clinical applications of

biomaterials.

**L – 30; Total Hours –30**

**TEXT BOOKS:**

1. Myer Kutz, Standard Handbook of Biomedical Engineering and Design, McGraw Hill, 2003
2. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and KratiJain. Implant biomaterials: A comprehensive review, World Journal of Clinical Cases, 2015.

**REFERENCES:**

1. John Enderle, Joseph D. Bronzino, Susan M. Blanchard, Introduction to Biomedical Engineering, Elsevier, 2005.
2. Park J.B., Biomaterials Science and Engineering, Plenum Press, 2007.
3. A.C Anand, J F Kennedy, M.MirafTAB, S.Rajendran, Woodhead Medical Textiles and Biomaterials for Healthcare, Publishing Limited 2006.
4. D F Williams, Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume, VCH Publishers 1992.

**COURSE OUTCOMES:**

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

- CO1:** differentiate common use of biomaterials as metals, ceramics, polymers and apply them to classify its chemical structure, properties and morphology.
- CO2:** comprehend ideas involving general properties of implant materials and apply the same to identify the benefits of implant materials.
- CO3:** attain knowledge about the biocompatibility & toxicological screening of biomaterials and realize its usage in real life.
- CO4:** reflect upon the practical ideas of using biomaterials

**Board of Studies (BoS) :**

BOS of Physics was held on 21.6.21

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

|                |                                    |          |          |          |          |
|----------------|------------------------------------|----------|----------|----------|----------|
| <b>PHDX 04</b> | <b>OPTICAL FIBRE COMMUNICATION</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  | (                                  | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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 optical receivers and 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 and configurations.

**CO2:**understand and assimilate the working principle of LED and Diode Laser.

**CO3:**select suitable photodetectors/sensors for different types of applications.

**CO4:**analyze the mechanism of optical amplifiers and analyze optical networks.

**Board of Studies (BoS) :**

BOS of Physics was held on 21.6.21

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>PHDX 05</b> | <b>SEMICONDUCTOR PHYSICS FOR</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  | <b>INFORMATION TECHNOLOGY</b>    | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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 and various display devices

**COB4:**To get insight to different types of data storage technologies

**MODULE I INTRODUCTION TO SEMICONDUCTOR DEVICES 6**

Semiconductors: N and P type, PN junction diode under forward and reverse bias — Zener diode, Schottky diode – Tunnel diode – bipolar junction transistor (BJT) - metal–oxide–semiconductor field-effect transistor (MOSFET), CMOS-concepts and fabrication.

**MODULE II FABRICATION OF SEMICONDUCTOR DEVICES 6**

Deposition of Semiconductor thin films – molecular beam epitaxy (MBE), chemical vapour deposition (CVD), pulsed laser deposition (PLD), magnetron sputtering, Types of lithography: Photo/ultraviolet /Electron-beam/Focused ion beam, Dip pen nanolithography, Etching process :Dry and Wet etching

**MODULE III OPTOELECTRONIC DEVICES 10**

Light Emitting Diodes (LED) - double hetero LED structure - LED characteristics - White LED – Applications, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical detection – PIN and avalanche photodiodes, Applications: Optical mouse, traffic lights, Luminescence, Cathode Luminescence, Electro Luminescence, Transparent Conductors, Liquid crystal displays – Dynamic scattering and Twisted nematic display, Display Glasses, Organic LEDs display, Charge-coupled devices (CCD), Inorganic Semiconductor TFT Technology, Organic TFT Technology; Flexible Displays, Touch Screen Technology.

**MODULE IV MEMORY STORAGE DEVICES 8**

Introduction to memory storage, Resistive Random Access Memory (ReRAM), Phase Change Memory (PCM); Magnetoresistive Random Access Memory (MRAM)- Giant 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, 3<sup>rd</sup> Edition, 2018
2. Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3. D. S. Dhaliwal et al., Prevail :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.

**REFERENCES:**

1. V.K. Mehta, Rohit Mehta, Principles of Electronics (Multicolour Edition) S. Chand Publishers, 10th Rev. Edn. 2006 Edition
2. Albert Malvino, David J. Bates Electronic Principles (SIE), McGraw Hill, 7th Edition, 2017
3. U. Mishra, J. Singh, Semiconductor Device Physics and Design, Springer, 2014
4. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, Wiley Publishers, 3ed 2008.
5. Bhattacharya Pallab, Semiconductor Optoelectronic Devices, Second Edition, By Pearson 2017
6. Joseph A. Castellano, Handbook of Display Technology, Springer, 1992
7. Yoshio Nishi, Advances in Non-volatile Memory and Storage Technology, Elsevier 2014

**COURSE OUTCOMES:**

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

**CO1:** understand the physics of semiconductor devices and identify its significance towards information technology (IT).

**CO1:** gain insight into various fabrication techniques towards therealization of nano-dimensional semiconductor devices.

**CO2:** attain knowledge on working principles of optoelectronic devices and display technologies and can recognize their importance in commercial applications.

**CO4:** learn the principle of data storage and its application towards futuristic memory technology.

**Board of Studies (BoS) :**

BOS of Physics was held on 21.6.21

**Academic Council:**17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

|                |                              |          |          |          |          |
|----------------|------------------------------|----------|----------|----------|----------|
| <b>PHDX 06</b> | <b>SENSORS AND ACTUATORS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  |                              | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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**

Photoconductors- Optical Detectors - Photodiodes, Phototransistors, 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),magnetron sputtering,Types of lithography:Photo/ultraviolet /Electron-beam/Focused ion beam, Dip pen nanolithography, Etching process :Dry and Wet etching

**MODULE IV MICROSYSTEMS AND ACTUATORS 7**

Microelectro-mechanical systems (MEMS) - RF- MEMS, Micro fabrication and Applications, Classification of transducers: electrostatic, piezoelectric,

thermal, Microsystem design and fabrication. working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications Solid-state switches, relays Solenoids, D.C. Motors, A.C. Motors, Stepper motors. Shape memory alloy actuators.

**L – 30; Total Hours –30**

**TEXT BOOKS:**

1. Jacob Fraden, Hand Book of Modern Sensors: physics, Designs and Applications, 3rd edition, Springer, New York, 2015.
2. Jon. S. Wilson, Sensor Technology Hand Book, 1st edition, Elsevier, Netherland, 2011.
3. John G Webster, Measurement, Instrumentation and sensor Handbook, 2nd edition, CRC Press, Florida, 2014.

**REFERENCES:**

1. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate (Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3<sup>rd</sup> 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:**17<sup>th</sup> AC held on 15.07.2021

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

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

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

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

|                |  |          |          |          |          |
|----------------|--|----------|----------|----------|----------|
| <b>PHDX 07</b> | <b>FUNDAMENTALS OF<br/>NANOTECHNOLOGY AND ITS<br/>APPLICATIONS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b>  |  | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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 polymer 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 – Nanoindenter – UV-VIS spectroscopy – FTIR, FT-Raman, Photoluminescence, NMR, ESR - Dielectric characterization – Magnetic characterization.

**MODULE IV APPLICATION OF NANO MATERIALS 7**

Applications of Carbon based nanomaterials (CNT, CNF, Graphene) - Biosensor (principle, component, types, applications) - agriculture (nano-

fertilizers, herbicides, nano-seed science, nano-pesticides) and food Systems (encapsulation of functional foods, nano-packaging) – Nano - electronics, Nano-optics.

**L – 30; Total Hours –30**

**TEXT BOOKS:**

1. Nanotechnology: An introduction to nanostructuring techniques by Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.

**REFERENCES:**

1. Nanotechnology: basic science and emerging technologies by Mick Wilson, Kamali Kannangara, Geoff Smith, and Michelle Simmons, Chapman & Hall/CRC; I edition, 2002.
2. Handbook of NanoScience, Engineering and Technology by Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., CRC Press, 2012.
3. Nanocomposite Science and Technology by P. M. Ajayan, L. S. Schadler, P. V. Braun, WILEY-VCH Verlag GmbH, 2003.
4. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

**COURSE OUTCOMES:**

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

**CO1:** understand basic principles of nanomaterials and apply them to differentiate the significance of nanomaterials compared to bulk materials.

**CO2:** familiarize the various synthesis methods of nanomaterials and compare them with the preparation of materials in bulk form.

**CO3:** get useful ideas about characterization techniques and differentiate different techniques.

**CO4:** understand the various applications of nanomaterials and realize the role of nanomaterials in various fields

**Board of Studies (BoS) :**

BOS of Physics was held on 21.6.21

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

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

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**CHEMISTRY ELECTIVE**

|               |  |          |          |          |          |
|---------------|--|----------|----------|----------|----------|
| <b>CHDX01</b> | <b>CHEMISTRY OF CONSTRUCTION<br/>MATERIALS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
|               |  | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**SDG: 9****COURSE OBJECTIVES:**

To impart knowledge on

**COB1:** the chemistry of cement and concrete**COB2:** the properties of steel and mechanism of corrosion**COB3:** the quality of water and its impact on concrete**COB4:** the analytical techniques for concrete research**MODULE I CHEMISTRY OF CEMENT AND CONCRETE 8**

Cement - chemical composition - Bogue's compounds - hydration of cement - hydrated products - influence of hydrated products on properties of cement - types of cement - microstructure of aggregate phase and hydrated cement paste - Interfacial transition zone in concrete: significance and microstructure

**MODULE II CHEMISTRY OF STEEL AND CORROSION 8**

Steel for construction - chemical composition - types of steels - influence of chemical composition on properties. Corrosion of steel - mechanism of corrosion of steel in water and concrete medium - types of corrosion of steel associated to civil engineering. Corrosion prevention and control: coatings & inhibitors - working mechanism. Cathodic protection to steel: Concept - working mechanism - sacrificial anodes

**MODULE III WATER CHEMISTRY FOR CONCRETE 7**

Water quality parameters – pH, solids, hardness, alkalinity, chloride and sulphates in water and their determination- Water quality for building construction – Effect of water impurities on concrete strength and durability- Carbonate and Sulphate attack-Chloride attack –Alkali-Silica reactions in concrete-Case studies

**MODULE IV ANALYTICAL TECHNIQUES FOR CONCRETE RESEARCH 7**

Analytical techniques for cement concrete research - FITR spectroscopy - SEM - XRD - Cyclic voltammetry (CV) - Thermo-gravimetric analysis (TGA) and Differential thermal analysis (DTA) - Advanced chloride and water analysis techniques.

**L – 30; Total Hours –30**

**TEXT BOOKS:**

1. Wieslaw Kurdowski, Cement and Concrete Chemistry, Springer Netherlands, 2014.

**REFERENCES:**

1. P.C Jain and Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi, 2013.
2. S S Umare 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, New York, 1984.
4. B. Sivasnagar, Engineering Chemistry, Tata McGraw - 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) :**

11<sup>th</sup>BoS of Chemistry held on 17.06.2021

**Academic Council:**

17<sup>th</sup> 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

|                |                                    |          |          |          |          |
|----------------|------------------------------------|----------|----------|----------|----------|
| <b>CHDX 02</b> | <b>CHEMISTRY OF MATERIALS</b>      | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>  | <b>AND ELECTROCHEMICAL DEVICES</b> | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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.



|     | 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.

|                |                                  |          |          |          |          |
|----------------|----------------------------------|----------|----------|----------|----------|
| <b>CHDX 03</b> | <b>CHEMISTRY AND</b>             | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>  | <b>INSTRUMENTATION FOR</b>       | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |
|                | <b>ELECTRICAL AND ELECTRONIC</b> |          |          |          |          |
|                | <b>APPLICATIONS</b>              |          |          |          |          |

**COURSE OBJECTIVES:**

**COB1:** Synthesis, properties and applications of electrical and electronic devices.

**COB2:** Classification and types of fuel cells.

**COB3:** Types of sensors and their applications.

**COB4:** Principle, instrumentation and applications of analytical techniques.

**MODULE I                      ELECTRICAL AND ELECTRONIC DEVICES                      7**

Solar Cell- Si solar cell, quantum dot solar cell, LCD : components, liquid crystals and their composition, electrodes – OLEDs: components, synthesis and modification of small molecules, polymers, phosphors - FRP-synthesis, properties and electrical applications - Solders : composition and uses – Capacitors : synthesis and modification of capacitor materials, fabrication.

**MODULE II                      FUEL CELLS                      7**

Difference between batteries and fuel cells - classification of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC), and solid oxide fuel cells (SOFC) microbial fuel cell, - hydrogen storage materials, challenges in using hydrogen as a fuel.

**MODULE III                      SENSORS                      7**

Definition, receptor, transducer, classification of chemical sensors based on operating principle of transducer, Ion-selective electrodes, Conductometric gas sensors (chemoresistors), Electrochemical sensors, Potentiometric MOSFET gas sensor, Touch sensors (oximeter, glucometer), Chemocapacitors, Biochips and microarray.

**MODULE IV                      ANALYTICAL TECHNIQUES                      9**

Voltammetry: cyclic voltammetry, electrogravimetry - principle, instrumentation and applications of: UV-Vis spectrophotometry, Atomic emission spectroscopy- Photoluminescence spectrophotometry, atomic absorption spectrophotometry – FT-IR spectroscopy, Raman spectroscopy, TGA-DTA analyzer, TEM.

**L – 30; Total Hours –30****TEXT BOOKS:**

1. P.C. Jain & Monica Jain, Engineering Chemistry, Dhanpatrai Publishing Company (P) Ltd., New Delhi (2016).

**REFERENCES:**

1. K.M. Gupta & Nishu Gupta, Advanced electrical and electronic materials: process and applications, Wiley-Scrivener (2015).
2. S. Vairam, P. Kalyani and Suba Ramesh, Engineering Chemistry, Wiley India Ltd., New Delhi (2011).
3. B. Viswanathan & M. Aulice Scibioh, Fuel Cells: Principles and Applications, University Press (2008).

**COURSE OUTCOMES:**

**CO1:** Illustrate the construction and applications of electrical and electronic devices.

**CO2:** Classify the fuel cells and elaborate the different types of fuel cells.

**CO3:** Explain the different types of sensors and their applications.

**CO4:** State the principle and illustrate the instrumentation of various analytical techniques.

**Board of Studies (BoS) :**

11<sup>th</sup>BoS of Chemistry held on 17.06.2021

**Academic Council:**

17<sup>th</sup> 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

|                    |                                 |          |          |          |          |
|--------------------|---------------------------------|----------|----------|----------|----------|
| <b>CHDX 04</b>     | <b>FUNCTIONAL MATERIALS AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 11, 12</b> | <b>APPLICATIONS</b>             | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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

|                 |  |          |
|-----------------|--|----------|
| <b>MODULE I</b> | <b>MATERIALS FOR HARDWARE AND DATA STORAGE</b> | <b>7</b> |
|-----------------|--|----------|

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, kevlar, biodegradable smart materials). Data storage and magnetic hard disk and devices- pendrive (flash memory-ferro magnetic and super paramagnetic materials, optical discs). 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.

|                  |  |          |
|------------------|--|----------|
| <b>MODULE II</b> | <b>ADVANCED MATERIALS AND APPLICATIONS</b> | <b>8</b> |
|------------------|--|----------|

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 (photodetectors and radiometers). Solder:-Lead based solder - issues and alternative for lead free solder (Conductive inks).

|                   |   |          |
|-------------------|---|----------|
| <b>MODULE III</b> | <b>MATERIALS FOR FABRICATION OF SENSORS</b> | <b>8</b> |
|-------------------|---|----------|

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. Aaftaab Sethi, Khusbhoo Joshi, K. Sasikala and Mallika Alvala, Molecular Docking in Modern Drug Discovery: Principles and Recent Applications, IntechOpen, (2019), DOI: 10.5772/intechopen.85991.
4. W-L. Xing, J. Cheng, Frontiers in Biochip Technology, Springer, 2006.
5. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, 3rd Edition, Springer, 2015.

#### **COURSE OUTCOMES:**

**CO1:** Identification of suitable materials in electronic gadgets and data storage systems.

**CO2:** Application of specific functionalized materials for advanced applications

**CO3:** Choose appropriate materials for fabricating the different types of sensors

**CO4:** Hands on experience of software and exposure to material properties

**Board of Studies (BoS) :**

15<sup>th</sup> BoS of Department of Chemistry held  
on 15.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

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

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

SDG: 11 &12

Statement : Identification of suitable materials towards the manufacturing of electronic gadgets and data storage systems without much affecting the natural resources and application of the fabricated devices to the sustainable cities and communities.



**MODULE IV LUBRICANTS****7**

Introduction – functions of lubricant- mechanism of lubrication - classification of lubricant – selection of lubricants - lubricating oils- properties of lubricant: viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue - semisolid: grease (sodium, calcium, lithium, aluminium) - solid lubricant: graphite, graphene, molybdenum disulphide – lubricating emulsions - cutting fluids – synthetic and semi-synthetic lubricants.

**L – 30; Total Hours – 30****TEXT BOOKS:**

1. Jain P.C and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Co., New Delhi. 2016.

**REFERENCES:**

1. Stephen R Turns, “An Introduction to Combustion: Concepts and Applications”, McGraw Hill Education, July 2017,
2. Samir Sarkar, “Fuels and Combustion”, University Press, 2009
3. Dipak K Sarkar “Thermal power plant: Design and operations – Chapter-3”, Elsevier, 2015.
4. E. McCafferty, “Introduction to Corrosion Science” Springer, May 2010.
5. Don M Pirro, Martin Webster, Ekkehard Daschner “Lubrication Fundamentals”, Taylor & Francis Gp,LLC, 2016.
6. Theo Mang, Wilfred Dresel “Lubricants and Lubrication” Wiley-VCH, 2017 2nd 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) :**

11<sup>th</sup>BoS of Chemistry held on  
17.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>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.

|               |   |          |          |          |          |
|---------------|---|----------|----------|----------|----------|
| <b>CHDX06</b> | <b>INSTRUMENTAL METHODS OF<br/>POLYMER ANALYSIS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG4</b>   |   | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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” 5<sup>th</sup> 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 & Ml 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) :

11<sup>th</sup>BoS of Chemistry held on  
17.06.2021

### Academic Council:

17<sup>th</sup> 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.



|                |                            |          |          |          |          |
|----------------|----------------------------|----------|----------|----------|----------|
| <b>CHDX 07</b> | <b>MEDICINAL CHEMISTRY</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b>  |                            | <b>2</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**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) - Semisynthetic penicillin, Streptomycin, Ciprofloxacin (Antibiotics) - Nevirapine and Zidovudine (Antiviral)

**MODULE III ANTINEOPLASTIC AND CARDIOVASCULAR DRUGS 8**

Synthesis, mode of action and side effect of Mechlorethamine, Cyclophosphamide, Melphalan, Fluorouracil, 6-Mercaptopurine (Antineoplastic) – Sorbitrate, methylprednisolone, Methyldopa, quinidine (Cardiovascular).

**MODULE IV STEROIDS AND RELATED DRUGS 7**

Synthesis, uses and mode of action - (A) Androgens -testosterone (B) Estrogens and progestational agents – progesterone, (C) Adrenocorticoids – prednisolone, dexamethasone, Remdesivir (D) Glucocorticoids – Cortisol (E) Anabolic steroids - 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, 3<sup>rd</sup> Edition, 2014.
4. Introduction to medicinal chemistry: How Drugs Act and Why, A. Gringuage, Wiley-VCH, 1996.
5. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry; Eleventh Edition; Lippincott Williams & Wilkins, 2004.

**REFERENCES:**

1. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley, 2<sup>nd</sup> 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) :**

11<sup>th</sup>BoS of Chemistry held on 17.06.2021

**Academic Council:**

17<sup>th</sup> 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.





Practice” , McGraw Hill Education India, Fifth Edition, India, 2017.

8. Mell Andrew and Walker Oliver, “The Rough Guide to Economics”, Rough Guide Ltd, 1<sup>st</sup> 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, 9<sup>th</sup> 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) :**

5<sup>th</sup>BoS of SSSH held on 29.12.2021

### **Academic Council:**

18<sup>th</sup> 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.

|                |                                 |          |          |          |          |
|----------------|---------------------------------|----------|----------|----------|----------|
| <b>SSDX 02</b> | <b>SOCIOLOGY OF SCIENCE AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 17</b> | <b>TECHNOLOGY</b>               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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. Ltd 2017
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) :**

5<sup>th</sup>BoS of SSSH held on 29.12.2021

**Academic Council:**

18<sup>th</sup> 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.

|                     |                                 |          |          |          |          |
|---------------------|---------------------------------|----------|----------|----------|----------|
| <b>SSDX 03</b>      | <b>INDUSTRIAL ECONOMICS AND</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 8 and 9</b> | <b>MANAGEMENT</b>               | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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.

9

**MODULE IV INDUSTRIAL POLICY**

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

5<sup>th</sup>BoS of SSSH held on 29.12.2021

**Academic Council:**

18<sup>th</sup> 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.

|                    |                                  |          |          |          |          |
|--------------------|----------------------------------|----------|----------|----------|----------|
| <b>SSDX 04</b>     | <b>DYNAMICS OF INDIAN SOCIAL</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 10, 16</b> | <b>STRUCTURE</b>                 | <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**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 III SOCIAL 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) :**5<sup>th</sup>BoS of SSSH held on 29.12.2021**Academic Council:**18<sup>th</sup> Academic council held on  
24.02.2022

|     | PO 1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO11 | PO 12 |
|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-------|------|-------|
| CO1 |      |     | H   |     |     | H   | M   |     |     | M     |      |       |
| CO2 |      |     | M   |     |     | M   | H   | L   |     |       |      | H     |
| CO3 |      |     | M   |     |     | M   | H   | L   |     |       |      | H     |
| CO4 |      |     | H   |     |     | H   | H   |     | M   |       |      | M     |
| CO5 |      |     | H   |     | H   | M   | H   | M   |     | H     |      | H     |

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

SDG 10: Reduce inequality within and among countries.

SDG16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

To sensitize and impart pertinent knowledge to youths to combat the contemporary issues and challenges facing Indian society in order to remedy its social pathos and injustices in the path of achieving sustainable development in India.

**MATHEMATICS ELECTIVE  
SEMESTER III**

|               |  |          |          |          |          |
|---------------|--|----------|----------|----------|----------|
| <b>MADX01</b> | <b>TRANSFORMS AND PARTIAL<br/>DIFFERENTIAL EQUATIONS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b> |  | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**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“, 10<sup>th</sup> edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2011.
2. Grewal B.S., “Higher Engineering Mathematics”, 44<sup>th</sup> 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“, 5<sup>th</sup> edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7<sup>th</sup> edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4<sup>th</sup> 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) :**

12<sup>th</sup> BOS of Mathematics & AS held on  
23.06.2021

**Academic Council:**

17<sup>th</sup> 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

|               |                             |          |          |          |          |
|---------------|-----------------------------|----------|----------|----------|----------|
| <b>MADX02</b> | <b>DISCRETE MATHEMATICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 9</b> |                             | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**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:** To introduce 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, 30<sup>th</sup> Reprint 2011.
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications:”, 7<sup>th</sup> Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

**REFERENCES:**

1. Ralph. P. Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4<sup>th</sup> 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”, 4<sup>th</sup> 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) :**

12<sup>th</sup> BOS of Mathematics & AS held on  
23.06.2021

**Academic Council:**

17<sup>th</sup> AC held on 15.07.2021

|     | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>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.

|               |                                   |          |          |          |          |
|---------------|-----------------------------------|----------|----------|----------|----------|
| <b>MADX03</b> | <b>PROBABILITY AND STATISTICS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b> |                                   | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**COURSE OBJECTIVES:**

**COB1:** To impart knowledge on the basic concepts of probability

**COB2:** To understand random variables and distribution functions

**COB3:** To acquaint with joint density function and generating functions

**COB4:** To introduce sampling techniques and estimation

**COB5:** To perform hypothesis testing and draw inference

**MODULE I BASIC PROBABILITY CONCEPTS 9+3**

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye’s theorem - Descriptive Statistics.

**MODULE II RANDOM VARIABLE AND DISTRIBUTION FUNCTIONS 9+3**

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

**MODULE III TWO DIMENSIONAL RANDOM VARIABLES 9+3**

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables- Generating functions.

**MODULE IV SAMPLING AND ESTIMATION 9+3**

Sampling distributions – basic knowledge on Random, simple random, stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

**MODULE V THEORY OF INFERENCE 9+3**

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student’s t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

**L – 45 ; T - 15; TOTAL HOURS – 60**

**TEXT BOOKS:**

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill New Delhi,

2008.

2. Miller, I., Miller, M., Freund, J. E., "Mathematical statistics", 7th Edition, Prentice Hall International, New Jersey 1999.
3. S.P.Gupta, "Applied Statistics", Sultan Chand & Sons 2015.

#### REFERENCES:

1. S.M.Ross, "Introduction to Probability and Statistics for Engineers and Scientists" Fifth Edition, Elsevier 2016
2. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons New Delhi 2012
3. Arora and Arora, "Comprehensive 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) :

12<sup>th</sup> BOS of Mathematics & AS

held on 23.06.2021

#### Academic Council:

17<sup>th</sup> 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

|               |                          |          |          |          |          |
|---------------|--------------------------|----------|----------|----------|----------|
| <b>MADX05</b> | <b>NUMERICAL METHODS</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>SDG: 4</b> |                          | <b>3</b> | <b>1</b> | <b>0</b> | <b>4</b> |

**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) :**

12<sup>th</sup> BOS of Mathematics and AS  
department held 23.06.2021

**Academic Council:**

17<sup>th</sup> 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