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

Regulations 2021
Curriculum and Syllabi
(Updated upto August 2025, as per 24th Academic Council)

B.Tech.
(Information Technology)

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

REGULATIONS 2021

CURRICULUM AND SYLLABI

(Updated upto August 2025 – as per 24th Academic Council)

B.TECH. INFORMATION TECHNOLOGY

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 INFORMATION TECHNOLOGY

VISION AND MISSION

VISION

- To be a leader in providing quality education and training in the field of Information Technology at Undergraduate and Postgraduate levels and undertake Research activities thereby contributing to the progress of the country.

MISSION

- To impart quality education and inculcate professionalism to suit the needs of the industries and society.
- To involve graduates in undertaking need based Research activities and disseminate the knowledge to develop entrepreneurial skills.
- To improve the professionalism through extension activities, industrial visits and in-plant training.
- To improve communicate effectively both in documentation and presentation.
- To create awareness of social, economic responsibilities ethically.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

B.TECH. (INFORMATION TECHNOLOGY)

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To provide students with core competence in mathematics, science and engineering conceptsessential to formulate, analyze and solve hardware / software engineering problems.

PEO2: To impart students with good breadth of knowledge in the core areas of information technology and related engineering so as to comprehend engineering trade-offs, analyze, design and synthesize data and technical concepts to create novel products and solutions for the real time problems.

PEO3: To train students in the use of tools and techniques for software development in different application domains and to grow as an entrepreneur.

PEO4: To prepare students to apply their knowledge and multifaceted skills to get immediate employment and excel in IT professional careers or awareness of the lifelong learning needed to continue their education in IT or related post graduate programmes to perform excellence, leadership and demonstrate good citizenship.

PEO5: To inculcate in students to maintain high professionalism and ethical standards, effective oral and written communication skills, to work as part of teams on multidisciplinary projects and diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will be able to:

PO1: apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

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

PO6: apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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: impart broad spectrum of knowledge and skill in the analysis, design, implementation and testing of software systems.

PSO2: provide problem solving capability through IT tools and techniques with adequate hands on experience to meet industry / research / societal needs.

REGULATIONS - 2021
B.TECH. DEGREE PROGRAMMES

(Under Choice Based Credit System)

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

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

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

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

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

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

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

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) 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 40% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean (Academic Affairs) during his / her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

4.1.4 Value Added Courses

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

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

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

above the curriculum during the period of study.

4.1.5 Industry Internship

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

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

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

4.1.6 Industrial Visit

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

4.2 Each course is normally assigned certain number of credits:

- one credit per lecture period per week
- one credit per tutorial period per week
- one credit for two to three periods and two credits for four periods of laboratory or practical 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 3rd to 8th semester is as follows:

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

ii) All the faculty members handling courses of the semester

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

iv) All faculty advisors and the class advisors

v) Head of the Department

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

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

10.5 The third meeting of the class committee, excluding the student members, shall meet after the semester end examinations to analyse the performance of the students in all the components of

assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the course 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 7th semester shall not be less than 60 credits (40 credits for lateral entry students).

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

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

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

12.2 Theory Course

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

12.3 Laboratory Course

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

12.4 Laboratory Integrated Theory Courses

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

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

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

12.6 Industry Internship

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

12.7 Project Work

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

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

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

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

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

13.0 SUBSTITUTE EXAMINATIONS

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

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

14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

14.1 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:

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

"W" - denotes withdrawal from the course

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

“U” - denotes unsuccessful performance in the course.

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

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

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

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

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

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

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

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a

similar manner, considering all the courses enrolled from first semester.

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

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

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

Percentage equivalent of marks = CGPA X 10

16.6 After successful completion of the programme, the degree shall be awarded to the students with the following classifications based on CGPA.

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

16.6.1 Eligibility for First Class with Distinction

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

16.6.2 Eligibility for First Class

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

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

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

performance of students and ranking.

17.0 SUPPLEMENTARY EXAMINATION

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

18.0 DISCIPLINE

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

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

19.0 ELIGIBILITY FOR THE AWARD OF DEGREE

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

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

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

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

iv) No disciplinary action pending against him/her.

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

20.0 MINOR DEGREE PROGRAMMES OFFERED FOR STUDENTS

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

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

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

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

		Electronics and Communication Engineering
7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering
8.	Robotics	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering
9.	3D Printing	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
10.	Electric Vehicles	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering

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

		(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Electrical and Electronics EngineeringElectronics and Instrumentation Engineering Electronics and Communication Engineering

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

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

21.0 POWER TO MODIFY

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

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

B.TECH. INFORMATION TECHNOLOGY

CURRICULUM FRAMEWORK, 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 Electronics Engineering*	3	0	2	4
3.	BSC	MAD 1181	Algebra and Differential Calculus	3	1	0	4
4.	ESC	GED 1101	Engineering Graphics	2	0	2	3
5.	ESC	GED 1102	Engineering Design	2	0	0	2
6.	ESC	GED 1103	Manufacturing Practices Laboratory**	0	0	2	1
7.	ESC	GED 1104	Programming for Problem Solving **	1	0	2	2
			Credits				**20** #

SEMESTER II

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

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC		Humanities Elective I	3	0	0	3
2.	BSC		Mathematics Elective	3	1	0	4
3.	PCC	ITD 2101	Digital Principles and Applications *	2	0	2	3
4.	PCC	ITD 2102	Programming in Python *	2	0	2	3
5.	PCC	ITD 2103	Computer Architecture	3	0	0	3
6.	PCC	ITD 2104	Data Structures and Algorithms	3	0	0	3
7.	PCC	ITD 2105	Fundamentals of Web Designing *	2	0	2	3
8.	PCC	ITD 2106	Data Structures and Algorithms Laboratory**	0	0	2	1
9.	HS	GED 2101	Essential Skills and Aptitude for Engineers**	0	0	2	1
			Credits				**24**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	ITD 2201	Programming in Java *	2	0	2	3
2.	PCC	ITD 2202	Database Management System *	3	0	2	4
3.	PCC	ITD 2203	Computer Networks *	3	0	2	4
4.	PCC	ITD 2204	Software Engineering	3	0	0	3
5.	PCC	ITD 2205	Operating Systems *	3	0	2	4
6.	PEC		Professional Electives	3	0	0	3
7.	HSC	GED 2201	Workplace Skills and Aptitude for Engineers**	0	0	2	1
8.	MC	GED 2202	Indian Constitution and Human Rights	2	0	0	0
			Credits				**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	ITD 3101	Information Coding Techniques	3	0	0	3
2.	PCC	ITD 3102	Object Oriented Analysis and Design	3	0	0	3
3.	PCC	ITD 3103	Mean Stack Web Development *	2	0	2	3
4.	PCC	ITD 3104	AI and Machine Learning *	3	0	2	4
5.	PCC	ECD 3181	Signals and Systems	2	0	0	2
6.	PCC	ITD 3105	CASE Tools Laboratory**	0	0	2	1
7.	PEC		Professional Elective Courses				6
8.	HSC	GED 3101	Communication Skills for Career Success **	0	0	2	1
9.	PROJ	ITD 3106	Internship I ##	0	0	0	1
			Credits				**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	MSD 3181	Fundmentals of 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	ITD 3201	Software Testing	3	0	0	3
5.	PCC	ITD 3202	Cloud Computing Technologies	3	0	0	3
6.	PCC	ITD 3203	Software Development Laboratory **	0	0	2	1
7.	PEC		Professional Elective Courses				6
8.	HSC	GED 3201	Reasoning and Aptitude for Engineers **	0	0	2	1
			Credits				**22**

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	ITD 4101	Internet of Things *	2	0	2	3
4.	PEC		Professional Elective Courses				12
5.	PROJ	ITD 4102	Internship II ###				1
9.	HSC	GED 4101	Employability Skills $	0	0	2	1
			Credits				**22**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PROJ	ITD 4201	Project work				9
			Credits				**9**

Overall Total Credits – 167

* Laboratory Integrated Theory course

** Laboratory Course

Three Week Orientation Programme – Mandatory Non-Credit Course

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

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

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

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LIST OF PROFESSIONAL ELECTIVE COURSES

SPECIALIZATION I
INFORMATION TECHNOLOGY APPLICATIONS

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Sem
1.	PEC	ITDX 01	User Interface Design	3	0	0	3	IV
2.	PEC	ITDX 02	Android Application Development*	2	0	2	3	IV
3.	PEC	ITDX 03	Principles of Programming Languages	3	0	0	3	IV
4.	PEC	ITDX 04	Graphics and Multimedia *	2	0	2	3	IV
5.	PEC	ITDX 05	Human Computer Interaction	3	0	0	3	IV
6.	PEC	ITDX 06	Swift Programming *	2	0	2	3	V
7.	PEC	ITDX 07	Introduction to NoSQL Databases *	2	0	2	3	V
8.	PEC	ITDX 08	Computational Intelligence	3	0	0	3	V
9.	PEC	ITDX 09	Natural Language Processing	3	0	0	3	V
10.	PEC	ITDX 10	C# and .NET Framework*	2	0	2	3	V
11.	PEC	ITDX 11	Introduction to DevOps	3	0	0	3	VI
12.	PEC	ITDX 12	E-Commerce and Digital Marketing	3	0	0	3	VI
13.	PEC	ITDX 13	Principles of Compiler Design	3	0	0	3	VI
14.	PEC	ITDX 14	Virtual Reality *	2	0	2	3	VII
15.	PEC	ITDX 15	Software Quality Management	3	0	0	3	VII
16.	PEC	ITDX 16	Enterprise Resource Planning	3	0	0	3	VII
17.	PEC	ITDX 17	Agile Methodologies	3	0	0	3	VII
18.	PEC	ITDX 18	Game Theory	3	0	0	3	VII
19.	PEC	ITDX 19	Functional Programming	3	0	0	3	VII

20.	PEC	ITDX 20	Full Stack Web Development	2	0	2	3	VII
21.	PEC	ITDX 21	UI and UX Desiogn	2	0	2	3	VII

SPECIALIZATION II

IOT & DATA COMMUNICATION NETWORK

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Sem
1.	PEC	ITDX 26	Principles of Communication	3	0	0	3	IV
2.	PEC	ITDX 27	TCP/IP Protocol Suite	3	0	0	3	V
3.	PEC	ITDX 28	Wireless Network	3	0	0	3	VI
4.	PEC	ITDX 29	Introduction to Industry 4.0 and Industrial IoT	3	0	0	3	VI
5.	PEC	ITDX 30	Adhoc and Sensor Networks	3	0	0	3	VII
6.	PEC	ITDX 31	Python for IoT *	2	0	2	3	VII
7.	PEC	ITDX 32	GPU Architecture and Programming	3	0	0	3	VII
8.	PEC	ITDX 33	Software Defined Networks	3	0	0	3	VII

SPECIALIZATION III

DATA SCIENCE & AI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Sem
1.	PEC	ITDX 41	Business and Data Analytics	3	0	0	3	V
2.	PEC	ITDX 42	Programming in R*	2	0	2	3	V
3.	PEC	ITDX 53	Mathematical Foundation for Data Sciences	3	0	0	3	V
4.	PEC	ITDX 54	Data Science Using Python *	2	0	2	3	V
5.	PEC	ITDX 43	Artificial Intelligence	3	0	0	3	VI
6.	PEC	ITDX 44	Data Mining Techniques and Tools *	2	0	2	3	VI

7.	PEC	ITDX 45	Big Data Analytics	3	0	0	3	VI
8.	PEC	ITDX 46	Soft Computing	3	0	0	3	VI
9.	PEC	ITDX 55	Machine Learning Using R	2	0	2	3	VI
10.	PEC	ITDX 47	Analytics of Things	3	0	0	3	VII
11.	PEC	ITDX 48	Artificial Intelligence for Data Science*	2	0	2	3	VII
12.	PEC	ITDX 49	Scalable Data Science	3	0	0	3	VII
13.	PEC	ITDX 50	Deep Learning *	2	0	2	3	VII
14.	PEC	ITDX 51	Computer Vision and Image Processing	3	0	0	3	VII
15.	PEC	ITDX 52	Predictive Analytics	3	0	0	3	VII
16.	PEC	ITDX 56	Deep Learning Using R	2	0	2	3	VII
17.	PEC	ITDX 57	Generative AI using Python	2	0	2	3	VII

SPECIALIZATION IV
CLOUD COMPUTING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Sem
1.	PEC	ITDX 61	Nextgen Technologies	3	0	0	3	IV
2.	PEC	ITDX 62	Distributed Computing	3	0	0	3	V
3.	PEC	ITDX 63	Virtualization Techniques *	2	0	2	3	V
4.	PEC	ITDX 64	Fog Computing *	2	0	2	3	VI
5.	PEC	ITDX 65	Cloud Services and Platforms *	2	0	2	3	VI

SPECIALIZATION V
CYBER SECURITY

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	Sem
1.	PEC	ITDX 71	Cryptography and Network Security	3	0	0	3	V

2.	PEC	ITDX 72	Security Analyst Fundamentals	3	0	0	3	VI
3.	PEC	ITDX 73	Ethical Hacking *	2	0	2	3	VI
4.	PEC	ITDX 74	Blockchain Technology	3	0	0	3	VII
5.	PEC	ITDX 75	Security in Computing	3	0	0	3	VII
6.	PEC	ITDX 76	Cyber Forensics	3	0	0	3	VII

PHYSICS ELECTIVES – II Semester

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

CHEMISTRY ELECTIVES – II Semester

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

6	CHDX 06	Instrumental Methods of Polymer Analysis	2	0	0	2
7	CHDX 07	Medicinal Chemistry	2	0	0	2

MATHEMATICS ELECTIVES – III Semester

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

HUMANITIES ELECTIVES – III Semester

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

HUMANITIES ELECTIVES – VI Semester

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

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

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1.	GEDX 201	Application of Fluid Mechanics in Everyday Life	3	0	0	3	Aero
2.	GEDX 202	Basics of Management and Organizational Behaviour	3	0	0	3	CSB
3.	GEDX 203	Big Data Analytics	3	0	0	3	CA
4.	GEDX 204	Biology for Engineers	3	0	0	3	SLS
5.	GEDX 205	Consumer Electronics	3	0	0	3	ECE
6.	GEDX 206	Creative Writing	2	1	0	3	English
7.	GEDX 207	Cyber Forensics	3	0	0	3	CSE
8.	GEDX 208	Cyber Security	3	0	0	3	IT
9.	GEDX 209	Disaster Management	3	0	0	3	Civil
10.	GEDX 210	English for Competitive Examination	2	1	0	3	English
11.	GEDX 211	Enterprise Risk Management	3	0	0	3	CSB
12.	GEDX 212	Fundamentals of Project Management	3	0	0	3	CSB
13.	GEDX 213	Industrial Robotics	2	0	2	3	Mech.
14.	GEDX 214	Internet of Things and its Applications	3	0	0	3	ECE
15.	GEDX 215	Introduction to Health Care Analytics	3	0	0	3	CA
16.	GEDX 216	IPR and Patent Laws	3	0	0	3	CSB
17.	GEDX 217	Logistics and Supply Chain Management	3	0	0	3	CSB
18.	GEDX 218	Nano Materials and Technology	2	0	2	3	Physics
19.	GEDX 220	Optimization Techniques	3	0	0	3	Maths
20.	GEDX 221	Polymers for Different Transportation	3	0	0	3	Polymer
21.	GEDX 222	Programming Language Principles	3	0	0	3	CSE
22.	GEDX 223	Public Speaking and Rhetoric	2	1	0	3	English
23.	GEDX 224	Python Programming	2	0	2	3	IT
24.	GEDX 226	Smart Sensors for Healthcare Applications	3	0	0	3	EIE
25.	GEDX 227	Total Quality Management	3	0	0	3	Mech.
26.	GEDX 228	Value Education	3	0	0	3	Commerce

27.	GEDX 229	Waste Water Management	3	0	0	3	Civil
28.	GEDX 231	Electronics for Mechanical Systems	3	0	0	3	ECE
29.	GEDX 232	Renewable Energy Engineering					EEE
30.	GEDX 233	Nuclear Hazard and Disarmament	3	0	0	3	Physics
31.	GEDX 235	Remote Sensing Essentials	3	0	0	3	Civil
32.	GEDX 236	Water and Waste Water Treatment	3	0	0	3	Civil
33.	GEDX 237	Cryptography and Network Security	3	0	0	3	IT

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 105	Building Repair Solutions	3	0	0	3	Civil
5.	GEDX 106	Cloud Services and Management	3	0	0	3	CA
6.	GEDX 108	Cyber Law and Ethics	3	0	0	3	CSL
7.	GEDX 110	Deep Learning Essentials /	3	0	0	3	CSE
8.	GEDX 111	Drone Technologies	2	0	2	3	Aero
9.	GEDX 112	Electric Vehicle	3	0	0	3	EEE
10.	GEDX 113	Emerging Technologies in Mobile Networks	3	0	0	3	ECE
11.	GEDX 114	Fundamentals of Data Science and Machine Learning	3	0	0	3	IT
12.	GEDX 115	Genetic Engineering	3	0	0	3	SLS
13.	GEDX 116	Green Design and Sustainability	3	0	0	3	Civil
14.	GEDX 117	Image Processing and its Applications	3	0	0	3	ECE
15.	GEDX 118	Industrial Automation and Control	3	0	0	3	EIE
16.	GEDX 119	Industrial Safety	3	0	0	3	Mech.
17.	GEDX 120	Industry 4.0	3	0	0	3	Mech.
18.	GEDX 121	Introduction to Artificial	3	0	0	3	IT

		Intelligence					
19.	GEDX 122	Introduction to Artificial Intelligence and Evolutionary Computing	3	0	0	3	CSE
20.	GEDX 123	Motor Vehicle Act and Loss Assessment	3	0	0	3	Automobile
21.	GEDX 126	Personal Finance and Investment	3	0	0	3	Commerce
22.	GEDX 127	Soft Computing Techniques	3	0	0	3	CSE
23.	GEDX 128	Value Analysis and Engineering	3	0	0	3	Mech.
24.	GEDX 129	Vehicle Maintenance	3	0	0	3	Automobile
25.	GEDX 130	Graphical Programming Based System Design	3	0	0	3	ECE
26.	GEDX 131	Business to Business Marketing	3	0	0	3	CSB
27.	GEDX 132	Introduction to Marketing Essentials	3	0	0	3	CSB
28.	GEDX 133	E – Business	3	0	0	3	CSB
29.	GEDX 135	Municipal Solid Waste Management	3	0	0	3	Civil
30.	GEDX 136	Automation in Production Systems and Management	3	0	0	3	Automobile
31.	GEDX 137	Dairy and food process and products	3	0	0	3	SLS

SEMESTER I

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

COURSE OBJECTIVES:

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

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

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

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

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

MODULE I ELECTROMAGNETIC WAVES 9

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

MODULE II QUANTUM MECHANICS 9

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

MODULE III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - Anti-reflection coating - Air Wedge – Michelson's Interferometer – Determination of wavelength of light and

thickness of thin transparent sheet-Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: Nd:YAG laser He-Ne laser and semiconductor laser - Applications : Laser Materials Processing - Holography.

MODULE IV INTRODUCTION TO SOLIDS 9

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

MODULE V PHYSICS OF SEMICONDUCTORS 9

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

PRACTICALS

List of Experiments

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

L – 45; P – 30 ; Total Hours –75

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

CO1: Express the knowledge of electromagnetic waves.

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

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

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

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

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

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

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

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

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

CHD1182	**CHEMISTRY FOR ELECTRICAL AND**	**L**	**T**	**P**	**C**
SDG: 9	**ELECTRONIC ENGINEERING**	**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

To make the students conversant with

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

COB2: synthesis, properties and applications of nanomaterials

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

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

COB5: types of corrosion and its prevention.

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS 10

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

MODULE II NANOMATERIALS 10

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

MODULE III BATTERIES 8

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

MODULE IV PHOTOCHEMISTRY 9

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

MODULE V CORROSION AND ITS PREVENTION 8

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

PRACTICALS

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

L –45; P – 30; Total Hours –75

TEXT BOOKS:

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

REFERENCES:

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

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

COURSE OUTCOMES:

The students will be able to

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

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

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

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

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

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

Academic Council: 15th AC held on 15.07.2021

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

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

SDG 9 : Industry, Innovation & Infrastructure

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

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

COURSE OBJECTIVES:

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

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

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

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

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

MODULE I MATRICES 9+3

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

MODULE II THEORY OF EQUATIONS 9+3

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

MODULE III DIFFERENTIAL CALCULUS 9+3

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

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

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

MODULE V ORDINARY DIFFERENTIAL EQUATIONS 9+3

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

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

L –45 ; T-15; Total Hours – 60

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

At the end of the course students will be able to

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

CO2: solve equations using the relations between roots and coefficients

CO3: apply differential calculus in various engineering problems

CO4: use differential calculus on several variable functions

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

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

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

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

Projection of plane lamina in first quadrant and its traces

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

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

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

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

MODULE IV THREE DIMENSIONAL PROJECTIONS L:4 P: 4

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

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

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

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

L – 30; P – 30; Total Hours – 60

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

After completion of the course, students should be able to

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

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

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

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

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

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

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

COURSE OBJECTIVES:

COB1: To learn the basic concepts of design in engineering

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

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

COB4: To introduce the role of innovation in engineering

MODULE I INTRODUCTION TO DESIGN 08

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

MODULE II DESIGN THINKING PROCESS 08

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

MODULE III PROTOTYPE DESIGN 07

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

MODULE IV INNOVATION 07

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

L – 30; Total Hours – 30

TEXT BOOKS:

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

REFERENCES:

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

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

COURSE OUTCOMES:

After completion of the course, students should be able to

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

CO2:analyse the problems and perform design thinking process

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

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

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

Academic Council: 17th AC held on 15.07.2021

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

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

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

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

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

COURSE OBJECTIVES:

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

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

COB3: To impart knowledge onsand mould preparation for simple components

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

COB5: To impart knowledge onDesign, assembly and testing ofelectronic circuits

PRACTICALS

List of Experiments:

CIVIL ENGINEERING PRACTICE:

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

MECHANICAL ENGINEERING PRACTICE

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

ELECTRICAL ENGINEERING PRACTICE:

1. Comparison of incandescent, fluorescent, CFL and LED lamps.
2. Domestic, staircase and go down wiring.
3. Measurement of earth resistance.
4. Study of protection devices (small relay, fuse, MCB, HRC, MCCB,

ECCB).

5. Familiarization of household electrical gadgets (Iron Box, Wet Grinder).
6. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE:

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

P –30; Total Hours –30

TEXT BOOK:

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

REFERENCES:

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

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: demonstrate Plumbing requirements of domestic buildings.

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

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

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

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

Board of Studies (BoS):	**Academic Council:**
18thBoS of MECH held on 21.06.2021	17th AC held on 15.07.2021

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

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

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

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

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

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 handing operations.

PRACTICALS

LIST OF PROGRAMS IN C:

1. Computer organization –Hardware in a typical computer Identification – Booting error messages and what it means
2. Structure of a basic program - Hello world program
3. Data types and Type conversions
4. Input / Output: Formatted functions – Unformatted functions – Library functions

5. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
6. Conditional Statements: If – if else- nested if else- goto- switch case – nested switch case
7. Iteration Statements: for loops – nested for loops – while loop – do-while loop – break and continue statement
8. I/O operations of one- and two-dimensional arrays
9. Bubble Sort and Linear Search using arrays.
10. Functions and its types, Recursion Function
11. Pointers File Operations

L – 15; P – 30; Total Hours – 45

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

Students who complete this course will be able to

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

CO2: bring out the importance of structural and procedural programming

CO3: write C coding using conditional and iteration statements

CO4: develop programs using Functions, Pointers and Files

CO5: implement program to build a real time application.

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

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	M	L	H	-	L	-	-	M	-	-	-	-	-
CO2	H	M	M	-	-	H	M	-	M	-	-	-	-	-
CO3	H	M	H	-	-	H	-	-	H	-	-	-	-	-
CO4	H	H	H	H	M	H	-	-	H	-	-	-	-	-
CO5	H	H	H	H	H	H	H	H	H	L	H	H	-	-

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

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

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

SEMESTER II

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

COURSE OBJECTIVES:

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

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

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

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

COB5: To sharpen their academic writing skills

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

MODULE I HUMAN RESOURCES 10

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

S: Introducing one self – exchanging personal info.

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

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

Voc. development: Prefixes, Suffixes

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

MODULE II TRANSPORT 10

L: Listening to long scientific talks

S: Sharing personal information – greeting, leave taking.

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

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

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

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

MODULE III ENERGY 9

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

S: Asking about routine actions & expressing opinions.

R: Locating Specific Information

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

Voc. development: Sequence words, misspelt words.

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

MODULE IV OUR LIVING ENVIRONMENT 8

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

S: Speaking about one's friend.

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

W: Argumentative writing.

Voc. Development: Synonyms, antonyms, phrasal verbs.

Lang. development: If clauses, Subject - Verb Agreement

MODULE V TECHNOLOGY 8

L: Listening to talks (General & Scientific).

S: Short group conversations.

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

W: Short essays, Dialogue writing.

Voc. Development: Idioms & Phrases.

Lang. development: Modal verbs.

L - 45; Total Hours - 45

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

CO3: Comprehend conversations and short talks delivered in English

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

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

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

Academic Council:
17th AC held on 15.07.2021

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

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

SDG No. 4 : Give Quality Education to all the Engineers

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

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

COURSE OBJECTIVES:

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

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

COB3: Tolearn about the analytic functions and their mapping properties

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

COB5: To introduce techniques and engineering applications of Laplace Transforms

MODULE I MULTIPLE INTEGRATION 9+3

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

MODULE II VECTOR CALCULUS 9+3

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

MODULE III COMPLEX DIFFERENTIATION 9+3

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

MODULE IV COMPLEX INTEGRATION 9+3

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

MODULE V LAPLACE TRANSFORMS 9+3

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

L - 45 ; T-15; Total Hours – 60

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:compute the area and volume using multiple integrals

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

CO3:verify analyticity, conformity and bilinearity of complex functions

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

CO5:solve ordinary differential equations using Laplace transforms

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

Academic Council: 17th AC held on 15.07.2021

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

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

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

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

COURSE OBJECTIVES:

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

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

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

COB4: To impart knowledge on friction and its applications

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

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

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

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

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

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

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

triangle, circle- composite sections, Hollow section using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia

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

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

MODULE V LAWS OF MOTION **L:8 T:3**

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

L – 45; T – 15; Total Hours – 60

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

After completion of the course, students should be able to

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

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

CO3: setermine the properties of surfaces

CO4: analyse and evaluate the frictional forces between the bodies

CO5: apply the laws of motion in solving dynamics problems

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

Academic Council:
17th AC held on 15.07.2021

	PO 1	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	-	-	-
CO3	-	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	-	M	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	L	-	-	-	-	-

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

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

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

GED 1202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

SDG: 3, 5, 8, 12

COURSE OBJECTIVES:

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

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

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

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

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

MODULE I DC CIRCUITS AND MEASUREMENTS 12

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

MODULE II AC CIRCUITS AND MEASUREMENTS 17

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

MODULE III ELECTRICAL MACHINES 18

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

MODULE IV SEMICONDUCTOR DEVICES AND APPLICATIONS 14

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

Transistorand its characteristics – JFET & MOSFET – their characteristics. Applications: Half wave and full wave rectifiers - Voltage Regulation – Regulator ICs.

MODULE V INTRODUCTION TO DIGITAL CIRCUITS 14

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

PRACTICALS

List of Experiments

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

L – 45 ; P – 30 ; Total Hours – 75

REFERENCES:

1. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 12th Edition, 2016.
2. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Education, First Edition, 2017.
3. Cotton H, “Electrical Technology”, CBS Publishers, 7th Edition, 2007.
4. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education, New Delhi, 2015.
5. Jacob Millman & Christos C. Halkias, Satyaprataba Jit “Electronic Devices and Circuits” McGraw Hill Education, 4th Edition, 2021.
6. Floyd, “Electronic Devices: Conventional Current Version” Pearson Education India, 7th Edition, 2008.
7. S. Salivahanan, N. Sureshkumar and A. Vallavaraj, “Electronic Devices and Circuits”, McGraw Hill Education (India) Pvt. Ltd., 2018.
8. Thomas L. Floyd, "Digital Fundamentals", 10th Edition Pearson Education Inc., New Delhi, 2008.

COURSE OUTCOMES:

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

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

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

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

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

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

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

Academic Council:
17th AC held on 15.07.2021

	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
CO 1	H	-	H	L	M	-	M	-	L	L	M	L	H	M	NA
CO 2	H	-	H	L	M	-	M	-	L	L	M	L	H	M	NA
CO 3	H	-	H	L	-	-	M	-	L	L	M	L	-	M	NA
CO 4	H	-	H	L	-	-	M	-	L	L	M	L	L	M	NA
CO 5	H	-	H	L	-	-	M	-	L	L	M	L	-	M	NA

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

SDG 3 :Good health and well being.

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

SDG 5: Gender equality

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

SDG 8: Descent work and economic

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

SDG 12: Responsible consumption and production.

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

ITD 1201	PROGRAMMING IN C++	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the basic concepts of object-oriented programming and C++

COB2: To impart the concepts of Constructor and Overloading in C++

COB3: To familiarize the concepts of Inheritance and Polymorphism in C++

COB4: To acquaint with the concepts of Template and Exceptions.

MODULE I OVERVIEW OF C++ 8+8

Introduction - Object oriented programming concepts; C++ fundamentals – Structure of C++ program, data types, variables, operators, control structures; ADT, Classes and objects, Inheritance, Polymorphism; Arrays, Pointers.

MODULE II CONSTRUCTOR AND OVERLOADING 8+8

Constructors - default constructor, parameterized constructor, copy constructor, destructors; Introduction to Function and Operator overloading; Function overloading; Operator overloading; Unformatted I/O, Formatted I/O.

MODULE III INHERITANCE AND POLYMORPHISM 7+8

Inheritance - Base class, Member accessibility, Single Inheritance, Multiple Inheritance, Virtual base class, Runtime polymorphism, Polymorphism - Virtual functions, pure virtual functions, dynamic binding.

MODULE IV TEMPLATES AND EXCEPTION 7+6

Class templates and Function templates; Exception handling - basics, try-catch-throw paradigm, exception specification, re-throwing an exception, uncaught exception.

PRACTICAL 30

LIST OF EXPERIMENTS

Students should develop and practice simple C++ programs using the following concepts.

1. Control statements
2. Classes and objects
3. Arrays
4. Pointers

5. Constructors
6. Function and operator overloading
7. Single and multiple inheritance
8. Exception handling

L – 30; P – 30; Total Hours – 60

TEXT BOOKS:

1. E. Balaguruswamy, “Object Oriented Programming with C++”, Tata McGraw Hill, 8th Edition, 2020.

REFERENCES:

1. Herbert Schildt, 'The Complete Reference C++', Tata McGraw Hill, 5th Edition, 2012
2. Deitel and Deitel, 'C++ How to Program', Pearson Education, 9th Edition, 2014
3. Bruce Eckel, 'Thinking in C++', Pearson Education, Second Edition, 2001.
4. James P. Cohoon, Jack W. Davidson, 'C++ Program Design - An Introduction to Programming & Object Oriented Design’, Tata McGraw Hill, 2nd Edition, 2000.

COURSE OUTCOMES:

CO1: Explain and apply the basic concepts of object oriented programming in C++ programs.

CO2: Describe, analyze, design and create programs (in C++) using Constructor and Overloading concepts.

CO3: Elucidate and create modular programs (in C++) with code reusability using Inheritance and polymorphism concepts.

CO4: Illustrate, apply, analyze, design and create programs (in C++) using Templates and Exceptions.

Board of Studies (BoS) :
14th BoS of IT held on 23.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	L	M		H		M	M	M	M	H	H
CO2	H	M	H	H	M		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	H	H
CO4	H	M	H	H	M		H		M	M	M	M	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 proper learning of the OOP leads to inclusive and sustainable economic growth, full and productive employment for the students.

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

COURSE OBJECTIVES:

To make the student conversant with the

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

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

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

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

MODULE I NATURAL RESOURCES 8

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

MODULE II ECOSYSTEMS AND BIODIVERSITY 8

Concept of an ecosystem - Food chains, food webs, Energy flow in the ecosystem - ecological pyramids - Ecological succession - Characteristic features, structure and function of (a) Terrestrial Ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem (b) Aquatic fresh water ecosystems: Ponds and lakes, rivers and streams (c) Aquatic salt water ecosystems: oceans and estuaries

Biodiversity and its conservation - Types: genetic, species and ecosystem diversity - Values of biodiversity - India as a mega-diversity nation - Invasive, endangered, endemic and extinct species - Hot sports of biodiversity and Red Data book - Threats to biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

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

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

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

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

Case studies related to current situation.

L – 30; Total Hours – 30

TEXT BOOKS:

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

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REFERENCES:

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

COURSE OUTCOMES:

The student will be able to

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

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

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

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

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

Academic Council: 17th AC held on 15.07.2021

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

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

ITD 2101	DIGITAL PRINCIPLES AND APPLICATIONS	L	T	P	C
SDG: 4		2	0	2	3

COURSE OBJECTIVES:

The students will

COB1: acquire the knowledge of various numbering systems and their applications

COB2: understand the different methods for simplification of Boolean Algebra

COB3: acquire knowledge for designing and implementing combinational logic circuits.

COB4: gain knowledge in design and implementation of sequential logic circuits

COB5: gain practical knowledge in design and implementation of various combinational and sequential logic circuits.

MODULE I NUMBER SYSTEMS, CODES AND DIGITAL LOGIC 7

Number Systems – Conversion of one number system to others – Binary codes: Weighted, Non-Weighted, Alpha Numeric – Boolean Algebra – Digital Logic – The Basic Gates – NOT,OR,AND – Universal Logic Gates – NOR,NAND – Other Gates – XOR, XNOR - Boolean Expression and their Implementation using logic gates – All NAND or NOR implementation.

MODULE II MINIMIZATION METHODS 7

SOP and POS forms of Boolean Expressions - Minimization of Boolean Expression using Boolean Algebra – Minimization using Karnaugh Map – Don’t-care Conditions – Minimization by Quine-McClusky Method.

MODULE III COMBINATIONAL LOGIC CIRCUITS 8

Design procedure of combinational logic - Binary Adder and Subtractor - Multiplexers – De-multiplexers – Decoders –Encoders – Code converters - Parity Generators and Checkers – Magnitude Comparator –- Read-only-Memory – PAL and PLA.

MODULE IV SEQUENTIAL LOGIC CIRCUITS 8

Flip-flops: RS Flip-flops, D Flip-flops, JK Flip-flops, T Flip-flops – Registers: Shift Registers, Universal Shift Registers– Counters: Asynchronous counters, Synchronous counters – Design of sequential circuits: State Transition diagram, State Synthesis Table, Design Equations and Circuit Diagrams,

State Reduction Technique.

PRACTICALS

1. Study of logic gates – AND, OR, NOT, NOR and NAND.
2. Simplification of Boolean functions and implementation with logic gates.
3. Design and implementation of multiplexers.
4. Design and implementation of demultiplexers.
5. Design and implementation of decoders
6. Design and implementation of encoders
7. Design and implementation of code converters.
8. Design and implementation magnitude comparators.
9. Design and implementation of adders and subtractors.
10. Design and implementation of parity generator and checker
11. Study of flip-flops- RS, D, JK and T Design and implementation of Registers with flip-flops.

L - 30 ; P - 30 ; TOTAL HOURS - 60

TEXT BOOKS:

1. M. Morris R. Mano and Michael D. Ciletti, 'Digital Design' , Pearson, Sixth Edition, 2018

REFERENCES:

1. John F. Wakerly, 'Digital Design – Principles and practices', Pearson Fourth Edition, 2018.
2. Sarah L.Harris, David Harris, 'Digital Design and Computer Architecture, Risc' Morgan Kaufmann Publishers, Fifth Edition, 2021
3. Michael D. Ciletti, 'Advanced Digital Design with the Verilog Hdl', Pearson Publication, 2010

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1 - Explain the different numbering systems, Boolean algebra, logic gates, and logic expressions.

CO2- Apply the principles of Boolean algebra and solve Boolean Expressions using Karnaugh Mapping and Tabulation Methods to minimize the complexity of the digital circuits.

CO3- Design the combinational logic circuits built with various logic gates.

CO4- Design the various synchronous sequential logic circuits built with different flip-flops.

CO 5 – Demonstrate the functions of various combinational and sequential logic circuits.

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

Academic Council:
18th Academic council held on 24.02.2022

COS / POS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	H	M	M	-	-	L	-	-	L	-	-	L	L	L
CO2	H	M	M	-	-	L	-	-	L	-	-	L	L	L
CO3	H	H	H	-	-	L	-	-	L	-	L	L	L	M
CO4	H	H	H	-	-	L	-	-	L	-	L	L	L	M
CO5	H	H	H	-	-	-	-	-	-	-	-	-	L	M

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

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

Students of both male and female are given designing skills of different types of combinational and sequential digital logic circuits. This will substantially increase the number of students who have relevant technical skills in Digital Principles and Applications for employment, decent job and entrepreneurship.

ITD 2102	PROGRAMMING IN PYTHON	L	T	P	C
SDG: 4		2	0	2	3

COURSEOBJECTIVES:

The students will

COB1: understand core programming basics - including data types, operators.

COB2: gain the knowledge incontrol structures, functions, lists, tuples, sets, modules and dictionaries.

COB3: acquire knowledge aboutthe fundamental principles of Object-Oriented Programming and File handling.

MODULE I INTRODUCTION TO PYTHON 10+10

Basics Elements of Python – Object, Expression -Variables -Data Types- Input – Output Statements- Operators-Casting-Comment-Strings - IF statement-loops-Arrays.

MODULE II FUNCTIONS AND EXCEPTION HANDLING 10+10

Functions and Scoping -Function Definitions – Keyword Arguments and Default values – Recursion -Global Variables – Modules - Tuples -Lists – Dictionaries-Sets -Exception Handling

MODULE III CLASSES AND FILE HANDLING 10+10

Abstract Data Types – Classes – Inheritance – Encapsulation and Information Hiding-File Open-Read, Write, Delete.

L – 30; P – 30 ;TOTAL HOURS - 60

PRACTICAL 30

LIST OF EXPERIMENTS

Students should develop and practice simple Python programs using the following concepts.

1. Data Types
2. Operators
3. Conditional branching
4. Strings
5. Loops
6. Arrays
7. Lists
8. Tuples

9. Sets
10. Dictionaries
11. Function
12. Modules
13. Classes & Objects
14. Inheritance
15. File

L - 30 ; P - 30 ; TOTAL HOURS - 60

TEXT BOOKS:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist', 2nd edition, Updated for Python 3, Shroff /O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCES:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013
3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
6. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO 1: demonstrate a comprehensive understanding of the fundamental elements of Python

CO 2: apply control structures to manage program flow and make decisions based on conditions.

CO 3: demonstrate efficient data handling using arrays

CO 4 **:** apply functions, recursion, and exception handling techniques in Python

CO 5: design and implement abstract data types and perform file handling operations effectively.

Board of Studies (BoS) :
15thBoS of IT held on 16.12.2021

Academic Council:
18th Academic council held on 24.02.2022

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

SDG4:Aimsatensuringinclusiveandequitablequalityeducationandpromote lifelonglearning opportunitiesforall.

Students of both male and female are given Python Programming language skill. This will substantially increase the number of students who have relevant technical skills in Python Programming for employment, decent job and entrepreneurship.

ITD 2103	COMPUTER ARCHITECTURE	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The students will:

COB1: have a thorough understanding of organization and operations of a digital computer.

COB2: study the operations of arithmetic logic unit.

COB3: explore in detail the different types of control and the concept of pipelining.

COB4: learn the hierarchical memory system including cache memories and virtual memory.

COB5: understand the different ways of communication with I/O devices and standard I/O interfaces.

MODULE I BASIC STRUCTURE OF COMPUTERS 10

Functional units - Basic operational concepts - Bus structures - Instruction codes – Computer Registers – Computer Instructions -Memory locations and addresses - Memory operations - Instruction and instruction sequencing - Design of accumulator Logic - Addressing modes - Basic I/O operations - Stacks and queues.

MODULE II ARITHMETIC AND BASIC PROCESSING UNIT 10

Addition and subtraction of signed numbers - Multiplication and division algorithms - Signed operand multiplication and division - Floating point arithmetic operations. Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Data Transfer and Manipulation – Program Control – Reduced Instruction Set Computers.

MODULE III CONTROL UNIT 9

Hardwired control - Microprogrammed control - Pipelining - Basic concepts - Data hazards - Instruction hazards - Influence on Instruction sets - Data path and control consideration - Superscalar operation.

MODULE IV MEMORY SYSTEM 8

Basic concepts - Semiconductor RAMs - ROMs - Speed - size and cost - Cache memories - Performance consideration - Virtual memory- Memory Management requirements - Secondary storage.

MODULE V INPUT / OUTPUT ORGANIZATION 8

Accessing I/O devices - Interrupts - Direct Memory Access - Buses - Interface

circuits - Standard I/O Interfaces (PCI, SCSI, and USB).

L – 45; TOTAL HOURS - 45

TEXT BOOKS:

2. M. Morris Mano, “Computer System Architecture” Revised Third Edition, Pearson Education, 2017.
3. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", 5th Edition, McGraw-Hill, 2012.

REFERENCES:

5. SmruthiRanjanSarangi, “Computer Organization and Architecture”, McGraw Hill Education (India) Pvt. Ltd., 2015.
6. William Stallings, "Computer Organization and Architecture - Designing for Performance", 9th Edition, Pearson Education, 2012.
7. John P. Hayes, "Computer Architecture and Organization", 4th Edition, McGraw- Hill, 2003.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Discuss the basic structure and operations of a digital computer.

CO2: describe instruction set, instruction format types and various addressing modes.

CO3: illustrate how a computer performs arithmetic operations

CO4: understand the importance of pipelining and memory organization.

CO5: explain the I/O organization, interrupts and interfaces

Board of Studies (BoS) :
15thBoS of IT held on 16.12.2021

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	2	1	2	2	-	2	-	-	1	2	-	2	2	-
CO2	3	2	-	1	-	-	1	1	1	1	-	2	2	1
CO3	3	-	1	1	2	1	-	-	-	1	-	1	1	-
CO4	3	1	-	-	1	-	-	1	-	1	-	2	2	-
CO5	2	1	1	1	1	-	-	1	-	1	-	3	1	1

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement: The proper learning of the Computer Architecture leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITD 2104	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students will:

COB1: understand the concepts of ADTs and linear data structures.

COB2: know about non linear data structures and their Applications.

COB3: learn the concepts of searching and sorting techniques.

COB4: familiarize graph related algorithms.

COB5: learn how ADTs can be applied to practical problems.

MODULE I LINEAR DATA STRUCTURES 9

Abstract Data Types - List ADT –Array based implementation – Linked list - Stack ADT – implementation of stack - Queue ADT – Circular Queue – Queue using linked list.

MODULE II NON LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

MODULE III SEARCHING AND SORTING 9

Linear Search – Binary Search - Insertion Sort - Shell Sort - Heap sort - Merge sort - Quick sort.

MODULE IV GRAPHS 9

Graphs – Definitions – Representation of Graphs – Graph Traversals – Topological Sort – Shortest Path Algorithms – Unweighted Shortest Path – Dijkstra's Algorithm - Minimum Spanning Tree – Prim's Algorithm.

MODULE V APPLICATIONS 9

Applications – Linear Data structures - List - Maintaining an inventory - Stack - conversion of infix to postfix expression - Queue - scheduler in OS - Priority queue - Applications of Depth First Search – Undirected Graphs.

L – 45; TOTAL HOURS - 45

TEXT BOOKS:

1. Mark Allen Weiss,“Data Structures and Algorithm Analysis in C++”, fourth edition, Addison-Wesley, 2013.

REFERENCES:

1. Aditya Bhargava, “Grokking Algorithms: An illustrated guide for programmers and other curious people”, Manning Publications, 2016
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, ”Introduction to Algorithms”, Third Edition, MIT Press, 2009.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second edition, Universities Press, 2008.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Exhibit an understanding of the abstract properties of various data structures such as Lists, Stacks and Queues.

CO2: Demonstrate the different methods for traversing trees and outline the concepts of hashing.

CO3: Apply the various searching and sorting algorithms.

CO4: apply graph data structures for solving real world problem.

CO5: choose an appropriate data structure and algorithm for a specified application.

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	3	2	-	-	-	-		-	-	-		-	1	2
CO2	2	2	-	-	-	-	2	-	-	-	2	-	2	2
CO3	2	1	2	1		-	-	-	-	-	-	-	1	2
CO4	3	2	1	1	2	-	-	-	-	-	-	-	2	2
CO5	2	2	1	-	3	-	-	-	-	-	-	-	2	3

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement : The linear and non linear data structures are used to implement efficient algorithms for real world applications and improve the usability of the software. This course will substantially increase the number of students who have relevant technical skills in the data structures for employment, decent job and entrepreneurship.

ITD 2105	FUNDAMENTALS OF WEB DESIGNING	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

Students will:

COB1: gain and understand the fundamentals of HTML

COB2: study to design web pages using CSS

COB3: learn JavaScript for dynamic web page design.

MODULE I HTML 10

Introduction – working of web – HTML structure – Text – List – Links – Images – Tables – Forms- video & audio - web site creation.

MODULE II CASCADING STYLE SHEETS 10

Introducing CSS – color – text – boxes – styling links- lists – tables – forms – layout – images – process and design –Advanced CSS - page layout in CSS - Web page design.

MODULE III PROGRAMMING WITH JAVASCRIPT 10

Introduction to scripting - simple program - memory concepts – arithmetic - decision making statements - control structures - JavaScript functions – objects - dynamic html event model – Angular JS – Node JS.

PRACTICALS

List of Experiments:

1. Writing scripts for adding text, images and hyper links
2. Creation of lists and tables for an application
3. Adding forms and multimedia to a Web page
4. Use color, text and styling options for a Web page
5. Designing a web page using HTML and advanced CSS
6. Write Java script codes for various arithmetic and logical operations
7. Write scripts using decision making and loops
8. Use functions and objects for designing web content
9. Design a dynamic web page with DHTML and JavaScript
10. Design dynamic web page using Angular and Node JS

L – 30 ; P –30 ; TOTAL HOURS –60

TEXT BOOKS:

1. Jon Duckett , “HTML and CSS: Design and Build Websites”, first edition, wiley publishers, 2011.
2. Laura Lemay, RafeColburn , Jennifer Kyrnin, “HTML, CSS & JavaScript Web Publishing”, seventh edition, Sams Publishing, 2015.

REFERENCES:

1. Jennifer Niederst Robbins , “Learning Web Design- A Beginners Guide to HTML, CSS, Javascript and Web Graphics”, fifth edition, O'Reilly Media, 2018.
2. Harvey M. Deitel, Paul J. Deitel, A. B. Goldberg, “Internet & World Wide Web: How to Program”, Third edition, Prentice Hall, 2003

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1:implement HTML 5 to add text, links, images, graphics and structure web page.

CO2: Apply CSS to implement color schemes, background designs, text formatting, page organization, and animated elements on web pages.

CO3 : Develop Dynamic Web Pages with JavaScript

CO4: Apply a structured approach to HTML, CSS, and JavaScript to design visually appealing and functionally efficient web pages

CO 5 : Enhance user interaction and engagement by employing dynamic features using JavaScript

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	3	1	1	2	1	-	-	-	1	1	-	-	3	2
CO2	3	3	1	1	3	-	-	-	1	1	-	-	3	2
CO3	3	3	3	1	1	-	-	-	1	1	-	-	3	2
CO4	3	3	1	1	1	-	-	-	1	1	-	-	3	2
CO 5	3	3	3	1	1	-	-	-	1	1	-	-	3	2

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement:

Students of both male and female are given HTML, CSS & JavaScript skills needed for web designing. This will substantially increase the number of students who have relevant technical skills in HTML, CSS, JavaScript, etc., for employment, decent job and entrepreneurship.

ITD 2106	DATA STRUCTURES AND ALGORITHMS LABORATORY	L	T	P	C
SDG: 8		0	0	2	1

COURSE OBJECTIVES:

The students will:

COB1: learn the concepts of List, stack and Queue ADTs

COB2: know about binary search trees and hashing

COB3: understand sorting algorithms

COB4: implement ADTs to solve practical problems

PRACTICALS

List of Experiments:

1. Array implementation of List ADT.
2. Array implementation of Stack ADT.
3. Implementation of Singly linked list for List ADT.
4. Linked list implementation of QueueADT.
5. Implementation of binary searchtree.
6. Program for tree traversal (inorder, postorder, preorder).
7. Implementation of Insertion sort.
8. Implementation of Quick sort.
9. Implementation of Dijkstra'salgorithm using graphs.
10. Implementation of any application using appropriate ADTs.

P -30; TOTAL HOURS – 30

TEXT BOOKS:

1. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C++", fourth edition, Addison-Wesley, 2013.
2. Aditya Bhargava, "Grokking Algorithms: An illustrated guide for programmers and other curious people**",** Manning Publications, 2016.

REFERENCES:

1. Reema Thareja, "Programming in C", Second Edition, Oxford University Press, 2016.
2. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.
3. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", second Edition, Career Monk Publications, 2011.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: implement linear/non–linear data structure operations.

CO2: write hash functions for efficient data storage.

CO3: implement various sorting algorithms

CO4: use appropriate data structures for real world applications.

Board of Studies (BoS) :

BoS of IT held on 16.12.2021

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			M										
CO2													H	
CO3					H		M							
CO4											H			H

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

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

Statement: The linear, non linear and hash data structures are used to implement efficient algorithms for real world applications and improve the data storage and data retrieval process with minimal time and space complexity. This course will substantially increase the number of students who have relevant technical skills in the data structures for employment, decent job and entrepreneurship.

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

COURSE OBJECTIVES:

COB1:To enable them to make effective business presentations

COB2:To train them to participate in group discussions

COB3: To enhance the problem-solving skills

COB4: To train students in solving analytical problems

MODULE I ORAL DISCOURSE 07

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

MODULE II VERBAL COMMUNICATION 08

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

MODULE III BASIC NUMERACY 08

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

MODULE IV ANALYTICAL COMPETENCY 07

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

L – 30; TOTAL HOURS - 30

REFERENCES:

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

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

COURSE OUTCOMES:

CO1: Make effective business presentations

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

CO3: To apply the various problem-solving techniques

CO4: Understand and solve aptitude problem

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

SEMESTER – IV

ITD 2201	PROGRAMMING IN JAVA	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

The students will

COB1: study the principles of object-oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism.

COB2: know fundamentals of object-oriented programming in Java, including defining classes, invoking methods, Packages, Interface and IO Streaming.

COB3: learn exception handling and design applications with threads in Java.

COB4: understand how to design GUI components with the Java Swing API.

MODULE I JAVA BASICS 8

Review of Object Oriented concepts - History of Java - Operators - Control statements - Constructors - Inheritance – Types and Real time Examples, Polymorphism - Dynamic Binding, Method Overriding.

MODULE II PACKAGES AND INTERFACE 7

Packages and Interfaces - Defining package - Importance - Interfaces – Interfaces vs. Abstract classes - Inner classes – Uses of inner classes, local inner classes – I / O STREAMS - Concepts of streams, Reading console Input and Writing Console output and File Handling.

MODULE III EXCEPTION HANDLING 8

Exception handling – Dealing with errors, benefits of exception handling, the classification of exceptions - exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions and Multithreading.

MODULE IV AWT CONTROLS & SWINGS 7

The AWT class hierarchy, user interface components - Working with Frame class, Color, Fonts and layout managers - EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events - Introduction to Swings, Hierarchy of swing components. Containers.

Practicals:

List of Experiments:

1. Java program using AWT GUIcomponents.
2. Java programs for layout manager.
3. Java program to create applets with the specific features like color palette, background, image insertion, radio buttons, and checkbox groupetc.
4. Programs to implement Java swingcomponents.
5. Java programs to implement thread, thread priority, multi threadconcepts.
6. Java programs for database connectivity using JDBC-ODBCconnectivity.
7. Installation and working of webserver like Apache Tomcat and application serversglassfish.
8. Java programs to create three-tier applications using servlets andJSP.
9. Create a web page using HTML (i.e include map,hotspots).
10. Create a web page with various kind of stylesheets.

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOKS:

1. Herbert schildt (2018), Java: The complete reference, 11th edition, Tata Mc graw Hill, New Delhi

REFERENCES:

1. Deitel and Deitel and Nieto “Internet and World Wide Web-How to Program”, Prentice Hall, 6th Edition, 2012.
2. E. Balaguruswamy, "Programming with Java" Mc Graw Hill India, 6th Edition, 2019.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Understand the fundamental OOP concepts such as encapsulation, inheritance, and polymorphism.

CO2: Apply java concepts to develop frontend and backend applications using Interface.

CO3: Comprehend and evaluate errors through the application of exception handling concepts.

CO4: develop interactive programs using applets and swings.

CO5: apply suitable data structure in java and develop application in swings

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	2	1	1	3	-	-	-	2	-	2	-	2	2	2
CO2	3	2	1	2	-	2	-	-	2	-	-	-	2	-
CO3	1	2	1	2	-	3	-	3	-	-	3	-	3	-
CO4	3	3	3	0	2	-	3	-	-	3	-	2	3	2
CO 5	3	3	3	1	1	-	-	-	-	2	-	-	3	3

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement:. The proper learning of the Programming in Java leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITD 2202 DATABASE MANAGEMENT SYSTEM L T P C
SDG: 8 3 0 2 4

COURSE OBJECTIVES:

The students will:

COB1: understand the essential features of database management systems and its use.

COB2: learn about the procedural and non-procedural language.

COB3: know the design principles of databases, as well as in the normalization approach.

COB4: understand the description of physical file structures and access methods.

COB5: explore the advanced topics and current trends of Databases.

MODULE I BASIC CONCEPTS 10+10

Introduction to Database and Transactions - Traditional file system and database - Database system three-tier architecture - Various components of database - Data models - Database Design using ER model – Introduction to SQL.

MODULE II RELATIONAL DATABASE AND DESIGN 10+5

Unary Operations: Select and Project - Relational Set operations - Binary Relational operators. Basic constraints in SQL - Joins, Aggregate & SORT functions - SQL Views and Privileges - Good schema design - Problems due to bad design schema- Functional dependencies: Definition-Inference rules for FD-minimal sets of FD- Normal forms up to BCNF- Dependency preserving and Lossless decomposition.

MODULE III DATA STORAGE AND INDEXING 9+5

Storage - File organization: Memory Hierarchies - Secondary Storage devices - Files - Fixed length and Variable length records. Operations on files: Sorted Files - Heap Files-Hashing and overflow handling techniques - Indexing structure for files: Different type of single-level ordered index- Multi level index-Dynamic multilevel indexing using B tree and B+ trees

MODULE IV TRANSACTION PROCESSING AND CONCURRENCY 8+5

Introduction to transaction processing: single-user verses multiuser - Need for Concurrency and recovery - Transaction states - ACID properties and Logs - Schedules based on Serializability: Conflict and View Serializability - Testing for Serializability - Cascading rollback and cascade less schedule – Concurrency control techniques: Locking, Lock compatibility matrix, Basic

Two-phase locking (2PL) protocol and various 2PL protocol, Timestamp-ordering based protocol. Deadlock prevention, Deadlock detection and Deadlock recovery

MODULE V ENHANCED DATA MODELS 8+5

Overview of object oriented concepts - Temporal databases - Introduction to multimedia and spatial databases - Distributed databases and issues - Types of distributed database systems - XML documents and XML Querying - Data mining concepts – Introduction to NoSQL& Columnar databases

PRACTICAL 30

LIST OF EXPERIMENTS

Students should develop and practice simple SQL queries and programs listed below:

1. Creation of Data Definition Language (DDL) to perform table creation, Alter, modify and drop commands in RDBMS.
2. Integrity and referential Constraints.
3. Data Manipulation Language Basic Queries in SQL, Joined tables in SQL, Aggregate functions in SQL, Group By and Having clause.
4. Working with Views.
5. Basic programs in Procedural Language using SQL (PL/SQL).
6. No_Data_Found, Too_Many_Rows Exception program using PL/SQL.
7. Programs using Cursors.
8. Programs using Functions and Procedures.
9. Triggers.
10. Database connectivity using MySQL.
11. Design and implementation of any application using database.

L – 45; P – 30; TOTAL HOURS – 75

TEXT BOOKS:

1. Silberschatz, A., Korth, H. F., &Sudarshan, “Database System Concepts”, McGraw-Hill, 7th edition, 2019.
2. Elmasri, R., &Navathe, S. B. “Fundamentals of Database Systems”, Pearson Education, 7th edition, 2016.

REFERENCES:

1. Raghu Ramakrishnan, “Database Management System”,3rd Edition, Tata McGraw-Hill Publishing Company, 2014.
2. Peter Rob and Carlos Coronel, “Database System, Design, Implementation and Management”, 9th edition, 2009.

3. C J Date, “An Introduction to Database System”, 8th Edition, 2004.
4. Hector GarciaMolina, Jeffrey D.Ullman and Jennifer Widom, “Database System Implementation”, Pearson Education, 2000.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Condense the essential principles and structure related to Database Management Systems (DBMS).

CO2: Construct queries utilizing relational algebra and SQL, alongside implementing normalization techniques for effective database design.

CO3: Explore different methods of file organization and indexing strategies.

CO4: Implement transaction processing and concurrency control in application software.

CO5: Apply query evaluation strategies and optimize queries for improved performance.

Board of Studies (BoS) :
15thBoS of IT held on 16.12.2021

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	3	2	2	1	1						2	2	3	3
CO2	3	2	3	3	2						2	2	3	3
CO3	3	2	3	3	2						2	2	3	3
CO4	3	2	3	3	2						2	2	3	3
CO5	3	2	3	3	2						2	2	3	3

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement: The proper learning of the Database Management System leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITD 2203	COMPUTER NETWORKS	L	T	P	C
SDG: 4		3	0	2	4

COURSE OBJECTIVES:

The students will

COB1: understand the computer networking basics and the functions of different layers in OSI Model and TCP-IP Model.

COB2: acquire the knowledge about the different error detection and correction methods and how the data flow is controlled in data communication.

COB3: learn the internetworking protocols and how to apply the subnetting scheme to efficiently use the IP addresses by reducing the wastage of addresses.

COB4: be conversant with the various transmission control protocols and congestion control mechanisms.

COB5: be familiar with various application layer protocols and algorithms for network security.

COB6:

MODULE I INTRODUCTION TO COMPUTER NETWORKS 9

Data communication: components, data representation, data flow – Networks: Network criteria, Physical Topology, Categories of Networks - Protocols and standards – Network Models: OSI and TCP/IP Model – Data Transmission: Transmission Impairments, line coding – Transmission Media: Guided and Unguided media.

MODULE II DATA LINK LAYER 9

Error detection and correction: CRC, Hamming code - Flow and Error control Protocols: Stop and Wait, Go back-N ARQ, Selective Repeat ARQ - HDLC – LAN: Ethernet, IEEE 802.3, IEEE 802.11 - Switches - Virtual LAN.

MODULE III INTERNET AND ROUTING PROTOCOLS 9

Logical Addressing – IPv4: Classfull Addressing, Classless Addressing, CIDR, NAT, Subnetting, Super netting, VLSM – IPv6: Structure, Address space, Advantages -- Routers – Routing Protocols - Distance Vector Routing - Link State Routing.

MODULE IV TRANSMISSION AND CONGESTION CONTROL MECHANISMS 9

Transmission control: Process to Process Delivery, Transmission Control

Protocols: UDP, TCP and SCTP- Congestion control: Open loop and closed loop congestion control methods, Congestion control examples in TCP and Frame Relay - Quality of Service.

MODULE V NETWORK SERVICES AND SECURITY 9

Domain Name System – Electronic Mail – Remote Connection – File Transfer – Hyper Text Transfer – Cryptography - Symmetric Key Cryptography - Asymmetric Key Cryptography – RSA Algorithm – Introduction to Software Defined Networks.

PRACTICALS

LIST OF EXPERIMENTS

1. Using Network Tools to verify the various addresses associated with network, connectivity between nodes in a network.
2. Basic configuration of Routers and Switches and Configuration of IP addresses in a computer and in the interfaces of a Router.
3. Creating simple peer to peer network.
4. Creating a Hubbed and switched Network.
5. Creating a Routed LANs
6. Creating a WAN with various classes of IP address and configured with RIP protocol.
7. Creating a WAN with subnetted IP addresses and configured with RIP protocol.
8. Creating a WAN with VLSM IP addresses and configured with RIP Ver 2 Protocol.
9. Creating a WAN with variable length subnetted IP addresses and configured with OSPF protocol.
10. Creating a Virtual LAN in a Switched Network.

L - 45 ; P - 30 ; TOTAL HOURS - 75

TEXT BOOKS:

1. Behrouz A.Forouzan,"Data Communication and Networking", 5th Edition, TataMcGraw-Hill, 2017.

REFERENCES:

1. Larry L. Peterson and Bruce S. Davie “ Computer Networks – A systems approach”, Morgan Kauffmann Series in Networking, 2021.
2. Dhanashree K. Toradmalle, “ Computer Networks and Network Design”, Wiley India Pvt.Ltd, 2020.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top

Down Approach", Sixth Edition, Pearson Education, 2017.
4. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, 2017.
5. Paul Goransson, Chuck Black, and Timothy Culver **"**Software Defined Networks: A Comprehensive Approach", Second Edition, Pearson Education, 2016.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1- Explain the terminology and fundamental concepts encompassed in the OSI reference model and the TCP/IP protocol suite.

CO2 - implement error detection/correction techniques, explain flow control protocols, and analyze LAN technologies.

CO3- Comprehend IPv4/IPv6 addressing, subnetting, and routing protocols to configure routers for efficient data transfer.

CO4 –Explain transmission control principles, analyze congestion control methods, and comprehend QoS concepts.

CO5 –Describe **the** network services like DNS and email, encryption methods, and the basics of SDN.

CO6: Apply the practical skills in network address verification, router/switch configuration, LAN and WAN setup, and VLAN implementation

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	PS O1	PS O2
CO1	3	1	1	1	1	-	-	-	1	1	1	1	1	2
CO2	3	3	2	1	1	-	-	-	1	1	1	1	1	2
CO3	3	3	3	1	1	-	-	-	1	1	1	1	1	2
CO4	3	3	1	1	1	-	-	-	1	1	1	1	1	2
CO5	3	1	1	1	1	-	-	-	1	1	1	1	1	2
CO 6	3	3	2	1	1	-	-	-	1	1	1	1	1	2

Note: 1- Low Correlation 2-Medium Correlation 3-High Correlation

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

This course imparts the knowledge of how the computers are connected to the network and communicate with each other. This course will substantially increase the number of students who have relevant technical skills in computer networks for employment, decent job and entrepreneurship.

ITD 2204	SOFTWARE ENGINEERING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The students will:

COB1: understand various software process models.

COB2: acquire the knowledge about software requirements engineering.

COB3: understand the fundamental concepts of software design and software design techniques.

COB4: gain knowledge in software testing techniques.

COB5: acquire software quality and software project management concepts.

MODULE I SOFTWARE PROCESS MODELS 7

The Software Process - Software Engineering Practice - Process Models – Agility and Process

MODULE II SOFTWARE REQUIREMENTS 9

Requirements Engineering - Establishing the Groundwork - Requirements Gathering - Developing Use Cases - Building the Analysis Model - Requirements Analysis - Scenario-Based Modeling - Class-Based Modeling - Functional Modeling - Behavioral Modeling

MODULE III SOFTWARE DESIGN 11

Design Concepts – Architectural Design – Designing Class Based Components - User Experience Design – Pattern Based Design

MODULE IV SOFTWARE TESTING 9

Strategic Approach to Software Testing - Planning and Recordkeeping - Test-Case Design - White-Box Testing - Black-Box Testing - Object-Oriented Testing - Integration Testing - Artificial Intelligence and Regression Testing - Integration Testing in the OO Context - Validation Testing - Testing Patterns – Specialized Testing for Mobility

MODULE V MANAGING SOFTWARE PROJECTS 9

Software Quality Assurance – Software Quality – Achieving Software Quality - Elements of Software Quality Assurance - SQA Processes and Product Characteristics - SQA Tasks, Goals, and Metrics - Formal Approaches to SQA - Software Configuration Management - The SCM Repository - The Change Management Process - Mobility and Agile Change Management - Software Risks Management - The SPI Process - The CMMI.

L - 45 ; TOTAL HOURS - 45

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 8th Edition, McGraw Hill Publication, 2019.

REFERENCES:

1. Sommerville, "Software Engineering", 10th Edition, Addison-Wesley, 2015.
2. Jordan Hudgens, “Skill Up: A Software Developer's Guide to Life and Career”, Packt Publishing, 2017.
3. John Sonmez , “The Complete Software Developer's Career Guide: How to Learn Programming Languages Quickly, Ace Your Programming Interview, and Land Your Software Developer Dream Job”, Simple Programmer, 2017.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Select an optimal software process model to guarantee successful software development.

CO2: Create a requirements specification document and conduct a comprehensive analysis of the stated requirements.

CO3: Architect a software system based on the specified requirements to ensure the development of a high-quality software product.

CO4: Formulate a comprehensive test case specification and execute testing of the software, employing different testing methodologies.

CO5: Elaborate on the principles of software quality and elucidate the methods of enhancing software development processes for better outcomes.

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	3	3	1	3	1	1	1	1	1	1	3	1		2
CO2	3	3	3	3	3				3		2	2	3	2
CO3	3	3	3	3	2	2			2		2	2	3	2

CO4	3	3	3	2	2				2		2	2	3	3
CO5	3	3	3	1	1				2					2

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement: The proper learning of the SE methodologies leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ITD 2205	OPERATING SYSTEMS	L	T	P	C
SDG: 8		3	0	2	4

COURSE OBJECTIVES:

The students will:

COB1: Learn different types of system software and operating systems.

COB2: Understand the concepts of process scheduling and compare the various scheduling algorithms and critical section problem.

COB3 learn deadlock and the different methods to handle the deadlock.

COB4: Understand the concepts of various memory management schemes.

COB5: Know about the file and disk management.

MODULE I INTRODUCTION TO SYSTEM SOFTWARE AND OPERATING SYSTEM 9

Introduction to system software - Editor- Assembler- Loader- Linker- Compiler & Interpreter- Macro-processors and Emulator- Operating System: Goals – Operating System Types: Multiprogramming- Timesharing- Distributed- Real-Time System – Computing Environments – System Components – Operating System Design & Implementation – Operating System Structure.

MODULE II PROCESS MANAGEMENT 9

Processes – Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling – Scheduling criteria, Scheduling algorithms, Multiple-processor, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization – The critical-section problem, Semaphores, Classic problems of synchronization, Critical regions.

MODULE III DEADLOCKS AND SYSTEM PROTECTION 9

Deadlocks: System Model – Deadlock Prevention - Deadlock Avoidance: Banker's Algorithm - Deadlock Detection - Deadlock Recovery - System Protection: Goals, Principles - System and Network Threats: Firewall - Port Scanner.

MODULE IV MEMORY MANAGEMENT 9

Main Memory Address Space–Swapping – Contiguous Memory Allocation: Fragmentation, Paging, Segmentation – Virtual Memory: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing, Virtualization: Memory Virtualization, Virtual Machine.

MODULE V FILE SYSTEMS AND I/O SYSTEMS 9

Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface – File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection - Allocation Methods, Free Space Management - I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

Practicals:

List of Experiments:

1. Study UNIX Commands & Utilities.
2. Study of Shell Programming
3. Creation of process using system calls, fork() & exec().
4. Implementation of Inter-process communication using pipes and filters.
5. Development of multi-threaded program.
6. Implementation of Semaphore.
7. Implementation of Scheduling algorithms (FIFO, SJF, Priority & Round-robin)
8. Implementation of Banker's algorithm for Deadlock avoidance.
9. Implementation of Port Scanner.
10. Implementation of First-fit, Best-fit and Worst-fit memory allocation strategies.
11. Implementation of page replacement algorithms.
12. Implementation of disk scheduling algorithms (SCAN, C-SCAN & LOOK)

L - 45 ; P - 30; TOTAL HOURS - 75

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, ‘Operating System Concepts’, Tenth Edition,2018 John Wiley & Sons (ASIA) Pvt. Ltd.

REFERENCES

1. S.Halder, Alex Aravind, ‘Operating Systems’, Pearson Education Second Edition 2016.
2. William Stallings, ‘The Operating Systems - Internal and Design Principles’, 7th Edition Prentice Hall, 2011.

COURSEOUTCOMES:

On completion of the course, students will be able to:

CO1: describe the different types of system software and operating systems

CO2: analyze the different CPU scheduling algorithms and process synchronization techniques.

CO3: discuss how the deadlock can be managed / avoided and systems can be protected

CO4: illustrate the various memory management schemes.

CO5: explain the concepts of file, disk and I/O management

Board of Studies (BoS) :

15th BoS of IT held on 16.12.2021

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	2	2	1	2			2			2	2		2	2
CO2	3	3	2	2	2	1							2	3
CO3	3	2	2	2	2								2	2
CO4	2	2	1	2	2		1			1	1		2	2
CO5	2	2	1	2	1		1			2	2		2	2

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

The proper learning of Operating Systems leads to inclusive and sustainable economic growth, full and productive employment for the students.

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

COURSE OBJECTIVES:

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

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

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

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

MODULE I EXTENSIVE READING & WRITING 07

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

MODULE II INTENSIVE READING & WRITING 08

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

MODULE III QUANTITATIVE APTITUDE 08

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

MODULE IV LOGICAL COMPETENCY 07

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

L – 30; TOTAL HOURS - 30

REFERENCES:

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

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

COURSE OUTCOMES:

CO1: Demonstrate reading skills with reference to business related texts

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

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

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

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

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
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.

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

COURSE OBJECTIVES:

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

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

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

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

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

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

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

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

MODULE III GOVERNANCE IN INDIA **8**

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

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

Human rights – meaning and significance - Covenant on civil and political rights - Covenant on Economic, Social and Cultural rights - UN mechanism

and agencies - The Protection of Human Rights Act, 1993 – watch on human rights and enforcement - Roles of National Human Rights Commission of India - Special Constitutional Provisions for SC & ST, OBC - Special Provision for Women, Children & Backward Classes.

L – 30; TOTAL HOURS – 30

TEXT BOOKS:

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

REFERENCES:

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

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

CO1: describe the emergence and evolution of Indian Constitution.

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

CO3: compare the various structure of Indian government.

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

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

Academic Council: 17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1			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.

SEMESTER V

ITD 3101	**INFORMATION CODING TECHNIQUES**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To learn the concept of information and entropy.

COB2: To understand the basic Modulation and its types.

COB3: To know about the encoder and decoder techniques.

COB4: To familiarize with text compression techniques.

COB5: To apply the error control coding techniques in the signals.

MODULE I INFORMATION ENTROPY FUNDAMENTALS 9

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding – Shannon-fano coding – Discrete Memory less channels – channel capacity – channel coding theorem – Channel capacity theorem.

MODULE II DATA AND VOICE CODING 9

Differential Pulse Code Modulation – Adaptive Differential Pulse code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

MODULE III BLOCK CODES 9

Definitions and Principles: Hamming weight - Hamming distance - Minimum distance decoding - Single parity codes - Hamming codes - Repetition codes - Linear block codes - Cyclic codes - Syndrome calculation - Encoder and decoder – CRC.

MODULE IV ERROR CONTROL CODING 9

Generator polynomial – Parity check polynomial – Convolutional codes – code tree trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding.

MODULE V COMPRESSION TECHNIQUES 9

Principles of text compression – static Huffman coding – dynamic huffman coding – arithmetic coding – image compression – graphics interchange format – tagged image file format – digitized documents – introduction to JPEG standards.

L – 30; TOTAL HOURS = 45

TEXT BOOKS:

1. Simon Haykin, 'Communication Systems', John Wiley and Sons, 4th Edition 2001.
2. Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002.

REFERENCES:

1. Mark Nelson, "Data Compression Book", BPB, 1992.
2. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

COURSE OUTCOMES:

CO1: Explain the different information coding theorems.

CO2: Discuss the various modulation methods to encode data and voice.

CO3: Apply the block codes and cyclic codes to detect errors.

CO4:Discuss how error control coding techniques are applied in communication systems.

CO5: Demonstrate the various text and image compression techniques.

CO6: Demonstrate the various audio and video compression techniques.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	L	H	H	M						M	L			M	
CO 2	M	H	M	M						L	L			M	
CO 3	H	L	L	M		H		H						L	
CO 4	M	H	M	M						L	L			M	
CO 5	L	H	L	L							H			M	
CO 6	L	H	L	L							H			M	

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

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

Statement: Case studies and problem-solving exercises will be used to stimulate learning and provide practical experience in addressing sustainable development issues

ITD 3102	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

Students will be able to

COB1: understand the object oriented life cycle.

COB2: know how to identify objects, relationships, services and attributes through UML.

COB3: gainknowledge in Object Oriented Design process.

COB4: learn concepts of quality design

COB5: analyze about software quality and usability.

MODULE I INTRODUCTION 9

An Overview of Object Oriented Systems Development - Object Basics - Object Oriented Systems Development Life Cycle.

MODULE II OBJECT ORIENTED METHODOLOGIES 9

Unified Approach - Development Process - Unified Modeling Language – Use case - Class diagram: The Essential - Advanced Concepts – Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram – Activity Diagram - Communication Diagrams - Composite Structure - Timing Diagrams.

MODULE III OBJECT ORIENTED ANALYSIS 9

Identifying use cases - Object Analysis: Classification - Identifying Object relationships, Attributes, and Methods.

MODULE IV OBJECT ORIENTED DESIGN - I 9

Design axioms - Designing Classes – Design Pattern

MODULE V OBJECT ORIENTED DESIGN - II 9

Access Layer: Object Storage and Object Interoperability, View Layer: Designing Interface Objects.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999.
2. Martin Fowler, "UML Distilled", 4th edition, Pearson Education, 2007.

REFERENCES:

1. John Deacon, "Object Oriented Analysis and Design", Pearson Education, 2009.
2. Bennett, Farmer, Steve McRobb, "Object-oriented Systems Analysis and Design: Using UML", McGraw-Hill Higher Education, 2010.
3. Grady Booch, "Object Oriented Analysis and Design with Applications", 3rd edition, Pearson, 2010.

COURSE OUTCOMES:

On completion of the programme students will be able to:

CO1: Outline the basics of object oriented system development life cycle.

CO2: Explain the various UML diagrams.

CO3: analyze software requirements to identify objects, attributes and methods.

CO4: describe software design process.

CO5: design software using UML diagrams.

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Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	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	3	3	1	1	1	1			1		3		2	2
CO2	3	1	1	1	1	3			3		3		1	2
CO3	3	3	3	1	1	1			3		3		3	
CO4	3	3	1	1	1	1			3	1	3		3	
CO5	3	3	3	3	1	2			2	2	1		3	2
CO5	3	3	1	1	1	1			1		3		2	2

Note: 1- Low Correlation 2- Medium Correlation 3 -High Correlation

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

Statement: The learning of the UML diagrams and software design concepts leads to design software for the business requirements and engineering problems and this will support the students to get employment.

ITD 3103	Mean Stack Web Development	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB 1: Translate user requirements into the overall architecture and implementation of new systems and Manage Project and Coordinate with the Client.

COB 2: Understand optimized front end code HTML and JavaScript

COB 3: Monitor the performance of web applications & infrastructure and troubleshooting web application with a fast and accurate Resolution.

COB 4: Learn concepts of end-to-end application.

COB 5: Design and implementation of Robust and Scalable Front End Applications.

MODULE I **Introduction to Web and Mongo DB** **7**

Introduction to Web: Internet and World Wide Web, Domain name service, Protocols: HTTP, FTP, SMTP. Html5 concepts, CSS3, Anatomy of a web page. XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX Approaches. Mongo DB: Introduction, Architecture, Features, Database Creation.

MODULE II **JavaScript** **8**

JavaScript: The Basic of JavaScript: Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions. Angular Java Script Angular JS Expressions: ARRAY, Objects, $eval, Strings, Angular JS Form Validation & Form Submission, Single Page Application development using Angular JS.

MODULE III **Node.js** **8**

Node.js: Introduction, Advantages, Node.js Process Model, Node JS Modules. Express.js: Introduction to Express Framework, Introduction to Nodejs , What is Nodejs, Getting Started with Express, Your first Express App, Express Routing, Implementing MVC in Express, Middleware, Using Template Engines, Error Handling , API Handling , Debugging.

MODULE IV **Restful Web Services** **7**

Restful Web Services: Using the Uniform Interface, Web Linking, Conditional Requests. React Js: Obstacles and Roadblocks, Working with the Files, Pure React,The Virtual DOM, ReactDOM, Children, Constructing Elements with Data, React Components.

PRACTICALS

1. HTML, CSS, JAVASCRIPT

    a. Create a student login form using form controls.

    b. Implement TO – DO - List using JavaScript with necessary style sheet.

2. MongoDB

    a. Implement CRUDE operations.

3 Angular.JS

    a. Write an Angular.Js program to illustrate angular directives.

    b. Create an Angular.JS Application validating the input.

    c. Implement an AngularJs application using controllers.

    d. Write an Angular.Js application illustrating filters.

4 Node.JS

a. Node.js Application that uses user defined module to return the factorial of given number.
b. Implement a Node.js Application that uses user defined module circle.js which exports functions area() and circumference() and display details on console.

c. Write a Node.js file that writes HTML form with an upload field.

5 React.JS

a. Write a program to create a simple calculator application using React JS components.
b. Implement a program to create a voting application using React JS Events.
c. Using React.Js list , create a Grocery list.

d. Write a Node.js file that writes HTML form with an upload field.

L – 30 ; P –30 ; TOTAL HOURS –60

TEXT BOOKS:

1. Programming the World Wide Web, Robet W Sebesta, 7ed, Pearson, January 2013.
2. Pro Mean Stack Development, ELadElrom, Apress., December 2016.
2. Hands-On Full Stack Development with Spring Boot 2 and React: Build modern

REFERENCES:

1. Chong Lip Phang,, ―Mastering Front-End Web Development: 14 Books in 1. Introducing 200+ Extensions‖,. N.P., Amazon Digital Services LLC - KDP Print US, 2020.
2. Kyrnin, Jennifer, and Meloni, Julie, ―C.. HTML, CSS, and JavaScript All in One‖, Pearson Education, 2018.
3. Ruby on Rails up and Running, Lightning-fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006).
4. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Blackbook, Dream Tech, January 2009.
5. Express.JS Guide, The Comprehensive Book on Express.js, AzatMardan, LeanPublishing, May 2014.
6. Modern Full-Stack Development: Using TypeScript, React,

Node.js, Webpack, and Docker, 1st ed. Edition Steve, 30th March 2020.

COURSE OUTCOMES:

On completion of the programme students will be able to:

CO1: Enumerate the Basic Concepts of Web , Markup Languages and Mongo DB.

CO2: Develop web Applications using Scripting Languages & Frameworks.

CO3: Make use of Express JS and Node JS frameworks.

CO4: Illustrate the uses of web services concepts like restful, React Js.

CO5: Apply Deployment Techniques and Work with cloud platform.

Board of Studies (BoS) :
18th BoS of IT held on 25.09.2022

Academic Council:
21st AC held on 20.12.2023

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	0	0	0	0	1	0	2	3	1
CO2	3	1	1	1	1	0	0	0	0	1	0	2	3	1
CO3	3	1	1	1	1	0	0	0	0	1	0	2	3	1
CO4	3	1	1	1	1	0	0	0	0	1	0	2	3	1
CO5	3	1	1	1	1	0	0	0	0	1	0	2	3	1

SDG 8 :

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

ITD 3104	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	L	T	P	C
SDG: 8		3	0	2	4

COURSE OBJECTIVES:

COB1: To understand the concept of Intelligent Agents

COB2: To learn search strategies and optimization problems

COB3: To solve problems using adversarial search techniques

COB4: To understand the various forms of learning

COB5: To know the importance of knowledge in different learning methods.

MODULE I INTELLIGENT AGENTS 9

Introduction to AI –Agents and Environments –Concept of rationality –Nature of environments –Structure of agents - Problem solving agents –search algorithms –uninformed search strategies.

MODULE II PROBLEM SOLVING BY SEARCH 9

Heuristic search strategies –heuristic functions - Local search and optimization problems –local search in continuous space –search with non-deterministic actions –search in partially observable environments –online search agents and unknown environments

MODULE III ADVERSARIAL SEARCH & LOGICAL AGENTS 9

Game theory –optimal decisions in games –alpha-beta search –monte-carlo tree search –stochastic games –partially observable games- Knowledge-based agents –propositional logic –propositional theorem-agents based on propositional logic.

MODULE IV LEARNING BY EXAMPLES 9

Forms of Learning – Supervised Learning – Learning Decision Trees – Evaluating and choosing the best hypothesis – theory of learning – regression and classification of linear models – Artificial Neural Networks.

MODULE V KNOWLEDGE IN LEARNING 9

Knowledge in learning – explanation based learning – learning using relevant information – Inductive logic programming – Statistical learning- Learning with complete data – Application domains : AI , Machine learning.

PRACTICALS

List of Experiments

1. Develop PEAS descriptions for given AI tasks
2. Implement basic search strategies for selected AI applications
3. Implement A* and memory bounded A* algorithms
4. Implement alpha-beta tree search
5. Implement local search algorithms
6. Implement propositional logic inferences for AI tasks
7. Implement the concept of decision trees with suitable data set from real world problem and classify the data set to produce new sample.
8. Implement facial recognition application with artificial neural network

L – 45 ; P –30 ; TOTAL HOURS –75

TEXT BOOKS:

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.

REFERENCES:

1. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
2. Dennis Rothman, “Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases”, Packt publishing, 2018
3. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Explain the agents and their intelligent behavior.

CO2: Identify the search strategies for efficient problem solving

CO3: Analyze the adversarial search techniques required for real world applications.

CO4: Evaluate decision trees, regression and classification models

CO5: Apply the knowledge based learning models for solving real world problems.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	1	2	2	1					2		3	1	1
CO2	2	1	1	1	1					1		2	2	1
CO3	3	3	1	1	1					1		3	1	1
CO4	3	3	1	1	1					1		2	1	1
CO5	3	1	1	1	1					1		3	1	1

Note: 1- Low Correlation 2-Medium Correlation 3-High Correlation

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

Statement : The problem solving methodologies of Artificial Intelligence and the learning strategies of machine learning helps to solve problems associated with any engineering domain and provides appreciable solution to real world problems.

ECD 3181	SIGNALS AND SYSTEMS	L	T	P	C
SDG: 3 & 9		2	0	0	2

COURSE OBJECTIVES:

COB 1: To define the concepts of Signals and Systems

COB 2: To analyze the performance of LTI system

COB 3: To solve the behavior of signal in time and frequency domain

COB 4: To apply transform techniques for continuous-time and discrete-time systems

PREREQUISITE: Fundamentals of Engineering Mathematics

MODULE I INTRODUCTION TO SIGNALS AND SYSTEMS 8

Discrete and Continuous Signals. Standard elementary signals, Basic operations on signals. Energy and Power of signals. Continuous-Time and Discrete-Time Systems, Linear and Time Invariant (LTI) Systems and its Properties, Impulse Response, Discrete-time and Continuous-time convolution.

MODULE II FOURIER ANALYSIS 8

Fourier Series representation of periodic signals. Complex exponential Fourier Series, Continuous-Time Fourier Transform and its properties. Frequency Response of CT- LTI Systems. Discrete-Time Fourier Transform (DTFT) and its properties.

MODULE III LAPLACE TRANSFORM ANALYSIS 8

Unilateral and Bilateral Laplace Transform. Region of Convergence (ROC), Properties of Laplace Transforms, Inverse Laplace Transform. System function using Laplace transforms method.

MODULE IV Z - TRANSFORM ANALYSIS 6

Z-Transform. Z-Plane and ROC. Properties of Z-Transform. Methods for Inverse Z-Transform, System function using Z transform method.

L – 30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid Nawab, "Signals and Systems", 2nd Edition, Pearson Education, 2015.

2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India Pvt Ltd., 2007.

REFERENCES:

1. Hwei P. Hsu, "Signals and Systems", 3rd Edition, Schaum's Outlines, McGraw Hill Education, 2017.
2. Won Young Yang, "Signals and Systems with MATLAB", 1st Edition, Springer, 2011.
3. John G. Proakis& Dimitris G Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, 4th Edition, Pearson India, 2007.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO 1 Classify the signals and systems

CO 2 Evaluate and operate on signals using various time-domain operations.

CO 3 Interpret and compare the properties of signals using Fourier, Laplace and Z-Transform techniques.

CO 4 Analyze the characteristics of LTI Systems using Fourier, Laplace and Z-Transform techniques.

CO 5 Implement Discrete-Time system function using Z transform method.

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

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

SDG 3 : Good Health and Well-Being

Statement: Signal processing plays a major role in medical instrumentation. A sound knowledge in these could lead to a substantial research and development in health and well being.

SDG 4: Ensure inclusive and equitable quality education and promote lifelong

learning opportunities for all.

Statement: Quality education will be impacted by applying the theoretical concepts to analyze the qualitative measures of signals and systems for further processing.

SDG 9 : Industry, Innovation and; Infrastructure

Statement: Signals and its processing form the basis for control systems and automation.

ITD 3105	CASE TOOLS LABORATORY	L	T	P	C
SDG: 8		0	0	2	1

COURSE OBJECTIVES:

Students will be able to

COB1: Define the process of object-oriented analysis and design to software development.

COB2: Pointing out the importance and function of each UML model throughout the process of object-oriented analysis

COB3: Design and explaining the notation of various elements in these models

COB4: Providing students with the necessary knowledge and skills in using object oriented CASE tools.

PRACTICALS

Prepare the following documents for two or three of the experiments listed below and develop the software using software engineering methodology.

1. Feasibility Study and Project Planning.
   Thorough study of the problem - Identify project scope, Objectives – Estimate the Cost.
2. Software Requirements Analysis.
   Develop Scenario-based Model, Class-based Model, and Behavioral Model.
3. Data Modelling.
   Business Flow Diagram - Use Case Diagrams and Activity Diagrams, Class Diagrams, Sequence Diagrams and add interface to Class Diagrams.
4. Software development and debugging.
5. Study of software testing tools.

LIST OF SAMPLE EXERCISES:

1. Student Marks Analyzing System.
2. Gas Booking System.
3. Online Flight Ticket Reservation System.
4. Employee Payroll Management System.
5. Course Registration System.

6. Hostel Room Allocation System.
7. Health Insurance Management System.
8. Online Mobile Recharging System.
10. Vacation Management System

P – 30 ; TOTAL HOURS – 30

COURSE OUTCOMES:

Students, on successful completion of the course should have gained the following skills

CO1: Prepare aProject Planning

CO2: Develop a requirements specification document

CO3: Create a design document

CO4: Implementcode using automated tools

CO5: Perform testing and debugging

CO6: Maintaining a software

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	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													
CO2		M												M
CO3			H							M				M
CO4			H		M									M
CO5													M	
CO5													M	

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

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

Statement:

By practicing UML diagrams and software design concepts, the students are able to apply the concepts to build software projects which can add to productive employment

GED 3101	COMMUNICATION SKILLS FOR CAREER SUCCESS	L	T	P	C
		0	0	2	1

SDG: 4

COURSE OBJECTIVES:

COB1: To develop students' proficiency in English at CEFR B2 level (Business Vantage)
COB2: To develop students' receptive skills (Listening and Reading) in a wide range of situations
COB3: To develop students' productive skills (Speaking and Writing) in a wide range of situations
COB4: To expose students to the nuances of the English language, grammar and usage.

MODULE I BRIEF EXCHANGES OF COMMUNICATION 08

Listening to telephonic conversations - gap filling exercises- short conversations – Promoting a product-Reading short passages and answering matching tasks- Writing short notes and messages. - Framing questions

MODULE II WORKPLACE COMMUNICATION 07

Listening to monologues - gap filling exercises - Mini presentations- role play- Reading longer texts – gap filling- Writing memo , emails and Fax - Writing reports on conferences, seminars

MODULE III INTERPERSONAL COMMUNICATION 08

Listening to conversations – Collaborative discussion using prompts - Reading comprehension-multiple choice-texts - Writing enquiry letters & replies to customers

MODULE IV NEGOTIATING AND PERSUADING 07

Listening to interviews - Group Discussions - Multiple choice and gap filling- writing work reports- cause and effect - Complaint letter and sales letter

TOTAL HOURS 30

REFERENCES:

1. Guy Brook-Hart, 'Business Benchmark-Upper Intermediate, 2nd edition, Cambridge University Press, Shree Maitrey Printech Pvt. Ltd, Noida, 2016.
2. Leo Jones, 'New International Business English' Students book. Cambridge University Press, Cambridge, 2003.
3. Simon Sweeney, 'Communicating in Business' Teacher's Book.

Cambridge University Press, Cambridge, 2004.
4. Simon Sweeney, 'Communicating in Business' Student's Book. Cambridge University Press, Cambridge, 2003.
5. Bill Mascull. 'Business Vocabulary in Use'. Advanced. Cambridge University Press, Cambridge, 2004

COURSE OUTCOMES:

CO1: Use the LSRW skills effectively in business and general situations

CO2: Demonstrate receptive skills effectively in various formal and informal communication situations.

CO3: Demonstrate productive skills effectively in various formal and informal communication situations

CO4: Use appropriate grammar and vocabulary in any context.

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

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O 3	PSO 4	PSO 5
CO1									M	H							H
CO2									M	H							H
CO3									M	H							H
CO4										H							M

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

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

This course helps the students to enhance their communication skills, critical thinking, problem solving, conflict resolution, team building and public speaking. This course also helps them to achieve success in their professional and personal life.

SEMESTER VI

MSD 3181	**FUNDAMENTALS OF ENTREPRENEURSHIP**	**L**	**T**	**P**	**C**
SDG: All 1-17.		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To understand the fit between individual and their entrepreneurial ambitions.

COB2: To identify the customers and find a problem worth solving.

COB3: To create a business model for solving the problems of customer, forming solution and present the Business Model Canvas

COB4: To develop a solution for customers' problem and analyze the problem solution fit & product market fit.

COB5: To build and demonstrate a Minimum Viable Product (MVP) for startup

MODULE I PROBLEM IDENTIFICATION AND OPPORTUNITY DISCOVERY 9

Entrepreneurial Thinking, Business Opportunities, Problem Identification, Design Thinking, Potential solutions, Presentation of the problem- Case Study

MODULE II CUSTOMER, SOLUTION AND BUSINESS MODEL 10

Customers and Markets, Identification of Customer Segment, Niche Segment, Customers Jobs, Pain and Gain, Early Adopters, Value Proposition Canvas-Case Study, Basics of Business Model-Lean Canvas-Case Study.

MODULE III VALIDATION AND FINANCIALS 10

Blue Ocean Strategy, Solution Demo, Problem – Solution Fit, Minimum Viable Product- Product Market Fit, Prototype – Case Study. Cost, Revenues, Pricing, Profitability Checks, Bootstrapping, Initial Financing and Pitching.

MODULE IV GO TO MARKET 8

Positioning and Branding, Golden Circle model: Sinek's theory value proposition, Branding Elements,Market Penetration Strategy, Collaboration Tools and Techniques, Channels – Case Study

MODULE V MANAGING GROWTH AND FUNDING 8

Sales Planning,Customer Acquisition Strategy, Selling Skills, Identifying Funding Sources, Mapping Start-Up Cycle to Funding Options, Funding Plan, , Creating business valuation

TOTAL HOURS – 45

TEXT BOOKS:

1. Entrepreneurship Rajeev Roy oxford, 2012.
2. https://web.nen.wfglobal.org/en/home - Wadhwani Foundation
3. W. Chan Kim , Renée A. Mauborgne**,** "Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant", Harvard Business Press, 2015.

REFERENCES:

1. Anil Lamba , "Romancing the Balance Sheet: For Anyone Who Owns, Runs Or Manages a Business", HarperCollins Publishers India, 2016.
2. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.
3. "Anatomy of Business Plan" – Linda Pinson, OMIM publication , Seventh Edition, 2008.
4. Running Lean: Iterate From Plan A To a Plan That Works, Ash Maurya, "O'Reilly Media, Inc.", 28-Feb-2012.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: Build an entrepreneurial mindset and reach out the customer to identify the problem using design thinking process

CO2: Craft solution to the problem through value proposition canvas and develop a business model using lean canvas

CO3: Provide product solution demo and deliver a minimum viable product

CO4: Work as a team and create brand strategy marketing for product/service

CO5: Prepare, make an outstanding sale pitch for startup

ITD3201	SOFTWARE TESTING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to enable the students

COB1: To discuss the distinctions between different levels of testing.

COB2: To describe the principles of software testing and maturity levels.

COB3: To describe strategies for generating system test cases.

COB4: To understand the essential characteristics of tool used for test automation.

COB5: Demonstrate the ability to apply multiple methods to develop reliability estimates for a software system.

MODULE I SOFTWARE TESTING-INTRODUCTION 9

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process - Basic Definitions, Testing Concepts and Definitions – TMM levels- Software Testing Principles - The Tester's Role in a Software Development Organization - Origins of Defects - Defect Classes - The Defect Repository and Test Design- Defect Examples - Developer/Tester Support for developing a defect Repository.

MODULE II STRATEGIES AND METHODS FOR TEST CASE DESIGN 9

Introduction to Testing Design Strategies - The Smarter Tester -Test Case Design Strategies - Using Black Box Approach to Test Case Design – Random Testing -Equivalence Class Partitioning - Boundary Value Analysis –Using White-Box Approach to Test design - Test Adequacy Criteria - Coverage and Control Flow Graphs - Covering Code Logic - Paths - White-box Based Test Design - Additional White Box Test design approaches - Evaluating Test Adequacy Criteria.

MODULE III LEVELS OF TESTING AND TESTING GOALS, PLANS AND POLICIE 9

The Need for Levels of Testing - MODULE Testing -Integration testing- System Testing - types of system testing - Acceptance Testing-types of acceptance test -testing OO systems - usability and accessibility testing- Testing and debugging Goals and policies-Test plan components-The role of three groups in Test Planning and Policy Development.

MODULE IV CONTROLLING & MONITORING 9

Introducing the test specialist - Skills needed by a test specialist - Building a Testing Group-Structure of the testing group- Measurements and milestones for controlling and monitoring-Criteria for test completion-software configuration management-Controlling and Monitoring: Three critical views.

MODULE V TEST MEASUREMENTS 9

Reviews as a testing activity-Types of Reviews-Developing a Review Program- Measurement program to support product and process Quality-Review of Quality concepts-Quality costs-An approach to usability Testing- Defect analysis and prevention-Defect casual Analysis.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, 2016.
2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson education, 2006.

REFERENCES:

1. Ralf Bierig, Stephen Brown, Edgar Galvan and Joe Tomoney, "Essentials of Software Testing", Cambridge University Press, 2022.
2. Limaye L G, "Software Testing - Principles, Techniques and Tools", Tata Mc- Graw Hill Education Pvt. Ltd., New Delhi, 2009.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1:Explain the various test processes and continuous quality improvement

CO2: Analyze the types of testing techniques and developing test case design

CO3: Design the writing proper test plan for an application

CO4: Build a test group and how to control and monitoring the testing process.

CO5: Discuss the various test measurement techniques

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2								2	2	3
CO2	3	2	2	2	2								2	2	3
CO3	3	3	3	2	2								2	2	3
CO4	3	2	2	2	2								2	3	3
CO5	3	3	2	2								2	2	2	3
CO6	3	2	2	2	2								2	2	3

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement: To develop efficient and effective test cases to assess the quality of software through the focus on software testing techniques and this will support the students to get employment.

ITD 3202	CLOUD COMPUTING	L	T	P	C
SDG: 8	TECHNOLOGIES	3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the service and deployment models of cloud

COB2: To learn thevarioustechnologiesavailableforcloud platforms.

COB3: To know the cloud storage providers and their services

COB4: To learn the concepts of Virtualization and Data Center.

COB5: To understand security issues and challenges incloud.

MODULE I CLOUD COMPUTINGBASICS 9

Introduction to Cloud Computing - Essential Characteristics - ArchitecturalOverview–ServiceModels–Deploymentmodels– Cloud computing vendors – Benefits of cloud computing –Limitations –Study on AWS – Azure – Google cloud platforms.

MODULE II CLOUD COMPUTINGTECHNOLOGY 9

Hardware and Infrastructure – Thick and thin clients – Cloud providersandconsumers – Cloud services - Accessing the cloud – Cloud PlatformsandFrameworks – Web Applications – Web API"s – WebBrowsers – Google App Engine – Enterprise Model – Elastic cloud model.

MODULE III CLOUD STORAGE 9

StorageasaService–CloudStorageProviders - CloudFileSystems-GFS - HDFS–BigTable,HBaseandDynamoDB–CloudDataStore–SimpleStorage Service.

MODULE IV DATA CENTER TECHNOLOGY 9

Virtualization Technology - Overview - Virtual Machines Provisioning- Virtual Machine Migration Services - VMLifeCycleandVMMonitoring - Remote Operation and Management – Computing Hardware – Storage Hardware – Network Hardware.

MODULE V CLOUD SECURITY 9

Cloud security, privacy and trust baselines – risk and trust assessment – enforcement of access policies - Data protection – secure cloud architecture – Disaster recovery – Case Studies.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. AnthonyT.Velte,TobyJ.Velte,RobertElsenpeter,"CloudComputing:A PracticalApproach",McGraw-Hill,2010.
2. Thomas Erl, Ricardo Puttini , Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice –Hall, 2013.
3. John R. Vacca, "Cloud Computing Security: Foundations and Challenges" CRC press, 2016.

REFERENCES:

1. Michael J. Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", Wiley, 2014.
2. Kai Hwang, Fox and Dongarra, Morgan Kaufmann, "Distributed andCloudComputing", 1st Edition, Elseiver,2012.
3. RajkumarBuyya,JamesBroberg,AndrzejGoscinski,"CloudComputingPrinciples and Paradigms", John Wiley & Sons, Inc Publications,2011
4. Tim Malhar, S.Kumaraswammy, S.Latif, "Cloud Security & Privacy",SPD, O'Reilly2009.

COURSE OUTCOMES:

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

CO1: Discuss the core concepts of cloud computing paradigm.

CO2: Identify the services, systems, platforms, frameworks to support cloud computing.

CO3: Explain the concepts of cloud storage system services.

CO4: Describe the data center technology from industry centric perspective.

CO5: Understand the cloud security issues and design secured cloud applications.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	2	1	2		1		1					1	2	2
CO2	2	1	2		1		1					1	2	2
CO3	2	1	2		1		1					1	2	2
CO4	2	1	2		1		1					1	2	2
CO5	2	1	2		1		1					1	2	2

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

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

Statement : The cloud models and the evolving cloud technologies help the organizations to provide solutions to compute, storage and network resources related issues.

ITD 3203	**SOFTWARE DEVELOPMENT LABORATORY**	**L**	**T**	**P**	**C**
SDG: 8		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: gain practical exposure on feasibility study and project planning

COB2: exercise requirements elicitation

COB3: gainexperience on software design using automated tools

COB4: practice application software

COB5: practice software testing and debugging

PRACTICALS

List of Experiments:

Note: List of exercises will be framed based on the professional elective chosen.

The project should be carried out with the following supporting documents

a) Requirement Analysis
b) Software Requirement Specification
c) Design
d) Implementation
e) Testing

Any one of the projects listed below should be carried out in detail

1. Software for a Game
2. Digital Classroom (Smart Class)
3. Course Scheduler
4. Stock Management
5. Photography Studio
6. Buy Big Mobile App
7. Online Quiz System
8. Entrance Exam System
9. Micro Social University Web App
10. Internal Assessment
11. Tourist Management System
12. Airline Reservation System
13. Payroll processing System

P – 30 ; TOTAL HOURS – 30

COURSE OUTCOMES: On completion of the course, students will be able to

CO1: prepare a software project plan.

CO2: develop software requirements specifications document

CO3: perform requirements analysis and prepare a design document for the given software

CO4: develop software code for the assigned requirements

CO5: develop a test case specification document

CO6: perform testing and debugging the code

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	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									M				M
CO2		M												M
CO3			H							M			M	
CO4														M
CO5														M

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

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

Statement: It provides deep knowledge on software development methodologies by practicing various software engineering concepts for application software, which can add to productive employment.

GED 3201	REASONING AND APTITUDE FOR	L	T	P	C
SDG: 4	ENGINEERS	0	0	2	1

COURSE OBJECTIVES:

COB1: To develop students' critical reading skills

COB2: To foster their writing skills

COB3: To enlighten the various methods of solving quantitative problems

COB4: To make students ready for clearing placement and competitive examination

MODULE I Objective English 07

Reading Comprehension - Sentence Rearrangement - Cloze Test – Error Spotting

MODULE II Vocabulary Development 08

Vocabulary (Synonyms and Antonyms, one word Substitutes, Spellings, Idioms and Phrases, etc) - Fill in the blanks - Paragraph Completion

MODULE III General Mental Ability 08

Time speed and Distance –Problems on Trains – Boats and Streams - Permutation and Combination - Probability

MODULE IV Quantitative Ability 07

Data Interpretation (charts, graphs, tables, data sufficiency, etc.) – Time and work-Pipes and Cisterns-Venn Diagrams-Mensuration

L – ; TOTAL HOURS 30

REFERENCES:

1. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.
2. Swan, Michael (2005). Practical English Usage, Oxford University Press.
3. Tyra .M, Magical Book On Quicker Maths, BSC Publishing Company Pvt. Limited, 2009
4. R. S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand Limited, 2017

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

COURSE OUTCOMES:

CO1: Demonstrate their reading ability

CO2: Exhibit their vocabulary and writing skills

CO3: Apply the problem-solving techniques

CO4: Gain confidence mentally and be successful in their career

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

Academic Council:
17th AC held on 15.07.2021

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

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

SDG No. 4 : Give Quality Education to all the Engineers

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

SEMESTER VII

ITD4101	**INTERNET OF THINGS**	**L**	**T**	**P**	**C**
SDG: 9		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

COB1: To introduce the basics of Internet of things

COB2: To understand Smart objects and IoT Architectures.

COB3: To learn the IoT protocols.

COB4: To discuss the features of cloud of things and web of things.

COB5: Outline the embedded prototyping and design and apply the use of Devices in IoT Technology.

COB5: To explain Real World IoT Design and compile the same

MODULE I INTRODUCTION to IOT 9

Definitions and Functional Requirements – IoT Network Architecture and Design - Drivers Behind New Network Architectures - Comparing IoT Architectures - The Core IoT Functional Stack- Smart Objects: The "Things" in IoT- Connecting Smart Objects -IOT Access Technologies.

MODULE II IOT PROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – ZigBee Architecture – Network layer – APS layer.

MODULE III WEB OF THINGS 9

Web of Things – Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

MODULE IV DESIGN PRINCIPLES OF CONNECTED DEVICES 9

Technology for design – Privacy in storing data – Internet principles for connected devices-Prototypes and production – Changing embedded platform – Open source versus closed source.

MODULE V PROTOTYPING EMBEDDED DEVICES 9

Prototyping embedded devices – Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

PRACTICALS

List of Experiments

1. Integration of Sensors and Actuators with Arduino-Traffic Control System
2. Working of Basic IoT Kit with Python Programming Networking
3. Implementation of IoT with Raspberry Pi - Raspbian OS – Blinking LED
4. Home Automation – Controlling lights using ESP8266
5. Sending Gmail notification when the door is opened or closed-sensed using Magnetic door sensor
6. Sensing the room temperature and monitoring it – using temperature sensor in ZigBee kit 7. Calculating distance using ultrasonic sensor
8. Program on RESTFUL API and XMAPP
9. IP based lighting control through Data Acquisition Card
10. Study on Industrial IoT

L –30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.

REFERENCES:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, Jhon Wiley and sons, 2014.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

COURSE OUTCOMES:

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

CO1:Recall the concept of IoT, its significance in modern technology and explain the diverse applications of IoT across various domains.

CO2:Classify the various IoT protocols used in diverse real-time scenarios and know the functions of them.
CO3:Summarize the concepts of Cloud of Things and Web of Things by recognizing the foundational differences and advantages of each approach.
CO4:Explain the design principles of connected devices by adapting to the changing embedded platforms.
CO5:Demonstrate the prototyping with various embedded devices and choose the suitable IoT platforms.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1		1					1	3	3	2
CO2	2	2	2	2	1		1					1	3	3	2
CO3	2	2	2	2	1		1					1	3	3	2
CO4	2	2	2	2	1		1					1	3	3	2
CO5	2	2	2	2	2		1					1	3	3	2

Note: 1- Low Correlation 2 -Medium Correlation 3 -High Correlation

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

Statement: IoT convert education in a way that would utilize knowledge and technology both together would make the learning resource a lot more powerful.

SEMESTER VIII

ITD4201	**PROJECT WORK**	**L**	**T**	**P**	**C**
SDG: 4		**0**	**0**	**18**	**9**

COURSE OBJECTIVES:

COB 1: To improve the co-ordination and communication skills

COB 2: To learn the software Engineering principles and to enhance the skill of analyzing and designing software.

COB 3: To gain knowledge of new tools and techniques and assess various issues.

COB 4: To understand Engineering and management principles.

COB 5: To Know ethics in project development and documentation

COURSE OUTCOMES:

Upon completion of this course, the students should be able to

CO1: Co-ordinate with team members and communicate effectively.

CO2: Apply, analyze and design software using software engineering principles.

CO3: Use the modern techniques and computing tools to implement the proposed Ideas and to asses societal, health, cultural issues

CO4: Demonstrate knowledge and understanding of the engineering and management principles and apply these to their project work

CO5: Recognize the need for life-long learning and documenting the ideas

CO6: Apply ethical principles in the project development and documentation.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	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
CO 1	H	L	L										L	L
CO 2	H	L	L										L	L
CO 3	L	H											L	L
CO 4	L	H	L										L	L
CO 5	L	H	L							H			L	L

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

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Understanding the concept of Blockchain Technology and its applications and analyzing the significance of it enable both the genders to get a quality education and promote their lifelong learning opportunities in the fastly growing internet field.

PROFESSIONAL ELECTIVE COURSES
SPECIALIZATION I
INFORMATION TECHNOLOGY APPLICATIONS

SEMESTER IV

ITDX 01	**USER INTERFACE DESIGN**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The students will

COB1: gain knowledge on the user interface design process.

COB2: learn business functions and to understand the user interface design principles.

COB3: be familiar on menus and windows.

COB4: understand how to use messages, controls, icons and images.

COB5: learn about android user interface design.

MODULE I DESIGN PROCESS 9

The Importance of Good Design – The Benefits of Good Design – Characteristics of the Graphical User Interface – Characteristics of a Web Interface – Principles of User Interface Design – The User Interface Design Process.

MODULE II BUSINESS FUNCTIONS AND PRINCIPLES 9

Know Your User or Client – Understand the Business Function – Understand the Principles of Good Interface and Screen Design.

MODULE III MENUS AND CONTROLS 10

Develop System Menus and Navigation Schemes – Select the Proper Kinds of Windows – Screen-Based Controls – Text and Messages – Effective Feedback and Guidance and Assistance.

MODULE IV VISUAL OBJECTS & TESTING 8

Meaningful Graphics – Icons and Images – Proper Colors Test – Test and Retest.

MODULE V ANDROID USER INTERFACE DESIGN 9

Android UI and Material Design – Understanding Views – The UI Building Blocks – Creating Full Layouts With View Groups and Fragments – Adding App Graphics and Resources – Prototyping and Developing the App.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Wilbert O. Galitz, “The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques”, 3rd Revised edition, John Wiley &Sons, 2007
2. Ian G. Clifton, “Android User Interface Design: Implementing Material Design for Developers “, Second Edition, Addison Wesley, 2017

REFERENCES:

1. Alon Cooper, “About Face: The Essentials of Interface Design, Fourth Edition, WILEY, 2016
2. Laura Klein, “UX for Lean Startups”, Shroff,2013
3. Jeff Gothelf, “Lean UX: Designing Great Products with Agile Teams”, Second Edition, Shroff/O’Reilly, 2016.
4. Patricia Harris, “What Is User Interface Design?”, Powerkids Press, 2017

COURSE OUTCOMES:

On completion of the course, students will be able to

CO1: explain the design process.

CO2: apply the design principles to develop a good user interface design.

CO3: designthe interface with suitable types of menus and controls.

CO4: create appropriate message windows, text messages, choose meaningful icons and colors.

CO5: develop user interface design for android applications.

Board of Studies (BoS) :
15thBoS of IT held on 16.12.2021

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	2	1	1	1	3	1	1	1	1	2	1		1	1
CO2	3	3	3	1	3	1	1	1	1	1	3	1	1	1
CO3	1	1	1	1	3					2	1		1	1
CO4	1	1	1	1	3					3			1	1
CO5	3	3	3	1	3	1	1			3			1	1

Note: 1- Low Correlation 2 – Medium Correlation 3 –High Correlation

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

Statement: The proper learning of the UID leads to inclusive and sustainable economic growth and productive employment for the students.

ITDX 02	ANDROID APPLICATION DEVELOPMENT	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To understand the purpose and benefits of Java programming for Android Application Development.

COB2: To learn the fundamentals of Android application development.

COB3: To make use of device features in the development of mobile applications and To know the development of simple mobile applications using Android

MODULE I JAVA FUNDAMENTALS 10

Introduction to Object Oriented Programming – Variables, Data Types, Control flow statements, Methods, Arrays – Collections – Exception Handling – Input / Output Streams – Multithreading – XML.

MODULE II ANDROID PROGRAMMING BASICS 10

Introduction – Android Basics – Android Architecture – Android Development Tools – Android SDK, AVD's – Anatomy of an Android Application – Layouts – Basic Views – Picker Views – List Views – Analog Clock and Digital Clock Views, Web Views – Intent Filter – Result from an Intent – Passing Data using an Intent Object – Calling Built-in Application using Intents.

MODULE III ADVANCED CONCEPTS 10

Shared Preferences – Internal Storage – External Storage – Creating and Using Database – Content Providers – Sending SMS, EMAIL – Displaying Map Services – Sensor Manager, Accelerometer, Gyroscope, SQLite – Performing Repeated Task in a Service – Introduction to Firebase – Google Play Store – Publishing of Android Application.

L – 30; P – 30 ;TOTAL HOURS = 60

PRACTICAL 30

LIST OF EXPERIMENTS

Students should develop and practice simple Java programs and Android Applications using the following concepts.

1. Control flow statements in Java
2. Methods and arrays in Java
3. Exception handling in Java

4. Multithreading in Java
5. Activity Life Cycle of Android
6. Basic Control/ Views of Android
7. Activities and Intents
8. Database – Firebase & SQLite
9. GPS location information
10. Alarm Clock
11. Sensors
12. Mobile application development in Android. (Students can select their own problem to develop an Application)

    Sample applications
    a. Scientific calculator
    b. Online shopping
    c. Student attendance and marks maintenance
    d. Bus route management
13. Games

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, O’Reilly Media,2017.
2. Herbert Schieldt , “Java: A Beginner’s Guide”, 7th Edition, Oracle Press, 2017.

REFERENCES:

1. John Horton, “Android Programming for Beginners”, Packt Publishing, 2015.
2. Wei-Meng Lee, “Beginning Android Application Development”, Wiley Publishing Inc, 2012.
3. Kevin Grant and Chris Haseman, “Beginning Android Programming: Develop and Design”, Peachpit press, 2014.
4. Android Studio official website: https://developer.android.com/studio.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Explain the basic constructs of Javaandwrite simple programsusing Java.

CO2: Describe the components and structure of a mobile development

frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.

CO3: Design, implement and deploy mobile applications using Android.

Board of Studies (BoS) :
BoS of IT held on 16.12.2021

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	M	M	L	M		H		M	M	M	M	H	H
CO2	H	M	H	H	M		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	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 proper learning of the Android Application Development leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 03 PRINCIPLES OF PROGRAMMING LANGUAGE L T P C
SDG: 8 3 0 0 3

COURSE OBJECTIVES:

The students will

COB1: Identify appropriate programming languages for certain classes of programming problems

COB2: Understand syntax, semantics, data types, bindings and scopes.

COB3: Understand expressions, assignment statements, control structures

COB4: Know the concept of OOPS

COB5: Understand exception handling and event handling

MODULE I INTRODUCTION TO PROGRAMMING LANGUAGES 9

The basic concepts of programming languages – Language Evaluation Criteria, influences on Language design – Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming – Syntax and Semantics.

MODULE II DATA TYPES 9

Lexical Analysis – The Parsing Problem, Recursive – Variables, The Concept of Binding, Named Constants, Data Types – Array Types, Associative Arrays, Record Types, Tuple Types, List Types, Union Types, Pointer and Reference Types, Type Checking, Strong Typing, Type Equivalence, Theory and Data Types.

MODULE III EXPRESSIONS AND CONTROL STRUCTURES 9

Expressions – Types of Expressions – Operators – Assignment Statements – Defining the Assignment – Types – Fundamentals of Subprograms, Design Issues for Subprograms, Local Referencing Environments, Parameter – Passing Methods, Design Issues for Functions – Overloaded Subprograms, Generic Subprograms – User-Defined Overloaded Operators – Subprograms, Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms, Blocks, Implementing Dynamic Scoping.

MODULE IV OBJECT ORIENTED PROGRAMMING CONCEPTS 9

The Concept of Abstraction – Design Issues for Abstract Data Types, Parameterized Abstract Data Types, Encapsulation – Object-Oriented Programming, Design Issues for Object-Oriented Languages, Support for Object-Oriented Programming in Specific Languages, Implementation of Object-Oriented Constructs, Introduction to Subprogram – Semaphores, Monitors,

Message Passing – Java Threads, C# Threads,

MODULE V EXCEPTION AND EVENT HANDLING 9

Introduction to Event Handling – Event Handling in Java, and C# - Introduction to Functional Programming – Fundamentals of Functional Programming Languages - A Brief Introduction to Predicate Calculus, Predicate Calculus and Proving Theorems – An Overview of Logic Programming, The Origins of Prolog, The Basic Elements of Prolog, Deficiencies of Prolog, Applications of Logic Programming.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Robert W. Sebesta, “Concepts of Programming Languages”, Eleventh Edition, 2019.

REFERENCES:

1. Maurizio Gabbrielli, “Simone Martini Programming Languages: Principles and Paradigms”, 2010
2. Kenneth C. Louden, Kenneth A. Lambert,“Programming Languages: Principles and Practice”, Third Edition, 2011.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1:discuss the basics of programming language paradigm

CO2: Analyze appropriate data types

CO3: apply appropriate expressions and control structures to solve the problems

CO4: explain the object oriented programming concepts

CO5:identify the appropriate programming language for the given problem domain.

Board of Studies (BoS) :

15thBoS of IT held on 16.12.2021

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	3	2	2	3	2							2	2	2
CO2	3	3	2	3	2								2	2
CO3	3	2	2	2	2							2	2	2
CO4	3	3	2		2							2	2	2
CO5	3	3	3	2	2							2	2	2

Note: 1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

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

Statement: The proper learning of Principles of Programming Language leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 04	GRAPHICS AND MULTIMEDIA	L	T	P	C
SDG: 4		2	0	2	3

COURSE OBJECTIVES:

The students will

COB1: be introduced the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them

COB2: learn the basic principles of 2-dimensional computer graphics.

COB3: study the basic principles of 3-dimensional computer graphics.

COB4: understand the multimedia system design from a world coordinates to device coordinates, clipping, and projections

MODULE I ILLUMINATION AND COLOR MODELS 7

Light sources – basic illumination models — Properties of light — Standard primaries and chromaticity diagram; Intuitive color concepts — RGB color model — YIQ color model — CMY color model — HSV color model — HLS color model; Color selection – Output primitives — points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

MODULE II TWO-DIMENSIONAL GRAPHICS 8

Two dimensional geometric transformations — Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing — viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations — point, line, and polygon clipping algorithms

MODULE III THREE-DIMENSIONAL GRAPHICS 7

Three dimensional concepts; Three dimensional object representations – Polygon surfaces – Polygon tables – Plane equations – Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Transformation and viewing Three dimensional geometric and 166odelling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

MODULE IV MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING **8**

Multimedia basics – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases. Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies.

L – 30; P – 30 ;TOTAL HOURS – 60

PRACTICAL **30**

LIST OF EXPERIMENTS

1. Implementation of Bresenham's Line/ Circle/ Ellipse Drawing Algorithm
2. Implementation of DDA Line Drawing Algorithm
3. Implementation of 2d Transformation for Line/ Circle/ Rectangle
4. Implementation of Window Viewport Mapping
5. Implementation of Cohen-Sutherland 2D Clipping
6. Implementation of 3d Transformation
7. Implementation of Visualization of Projection of 3d Images
8. Implementation of Color Conversion From RGB to HSV/ HSV to RGB
9. Implementation of Text Compression
10. Study of Adobe Photoshop 7.0 Tools
11. Basic Operations Using Photoshop 7.0
12. Study of Macromedia Flash 8.0
13. Animation Using Macromedia Flash 8.0

TEXT BOOKS:

1. Donald Hearn ,M.Pauline Baker, "Computer Graphics " , PHI
2. Buford , "Multimedia Systems", Pearson

REFERENCES:

1. Jose Lozano ,"Multimedia: Sound and Video" , PHI
2. S.Pandey, M.Pandey,Katson, "Multimedia Systems,Tech. & Communications"

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: list the basic concepts used in computer graphics.

CO2: explain and implement 2D transformation, viewing and clipping.

CO3: explain and implement 3D transformation, viewing and clipping.

CO4: explain the fundamentals of multimedia applications and implement file handling.

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	M	M	L	M		H		M	M	M	M	H	H
CO2	H	M	H	H	M		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	H	H
CO4	H	M	H	H	M		H		M	M	M	M	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: This course will substantially increase the number of students who have relevant technical skills in Graphics & Multimedia for employment, decent job and entrepreneurship.

ITDX 05	HUMAN COMPUTER INTERACTION	L	T	P	C
SDG: 8 , 9		3	0	0	3

COURSE OBJECTIVES:

The students will

COB1: learn common methods in the user-centered design process and the appropriateness of individual methods for a given problem.

COB2: be able touse, adapt and extend classic design standards, guidelines, and patterns.

COB3: acquire knowledge toimplement selected design methods and evaluation methods at a basic level of competence.

COB4: be able todevelop prototypes at varying levels of fidelity, from paper prototypes to functional, interactive prototypes.

COB5: design dialog box based on FSM,State charts and Petri Nets.

MODULE I INTRODUCTION 9

Historical evolution of the field – Concept of usability – definition and elaboration – HCI and software engineering – GUI design and aesthetics – Prototyping techniques.

MODULE II MODEL- BASED DESIGN AND EVALUATION 9

Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS)- Fitt's law and Hick-Hyman's law- Model-based design case studies.

MODULE III GUIDELINES IN HCI 9

Schneiderman's eight golden rules – Norman's seven principles – Nielsen's ten heuristics with example of its use – Heuristic evaluation – Contextual inquiry – Cognitive walkthrough.

MODULE IV EMPIRICAL RESEARCH METHODS IN HCI 9

Introduction (motivation, issues, research question formulation techniques) – Experiment design and data analysis (with explanation of one-way ANOVA) – Hierarchical task analysis (HTA) – Engineering task models and Concur Task Tree (CTT).

MODULE V DIALOG DESIGN 9

Introduction to formalism in dialog design, design using FSM (finite state machines) – State charts and (classical) Petri Nets in dialog design –

Introduction to CA, CA types, relevance of CA in IS design – Model Human Processor (MHP)

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Robert (Munro) Monarch., Human-in-the-Loop Machine Learning: Active learning and annotation for human-centered AI, 2021

2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.

REFERENCES:

1. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.
2. B. Shneiderman; Designing the User Interface, Addison Wesley 2000 (Indian Reprint).
3. Selected research papers (details will be provided at the end of relevant materials).
4. Jacob Nieilsen; Useability Engineering; Morgan Kaufmann, Academic Press, London.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: describe the basics of HCI.

CO2: explain the models used for HCI.

CO3: explain various rules and guidelines used in HCI.

CO4: describe the Empirical research methods

CO5: design various Dialog Design used for HCI

Board of Studies (BoS) :

15thBoS of IT held on 16.12.2021

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

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

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

Statement: The proper learning of the HCI is aimed at providing inclusive and sustainable economic growth, full and productive employment for the students.

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

Statement: Human-Computer Interaction is intended to transform our society into a more sustainable one by building a resilient HCI infrastructure, promote inclusive and sustainable industrialization and foster innovation.

SEMESTER V

ITDX 06	SWIFT PROGRAMMING	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB 1: To know the fundamentals of swift programming for mobile app development.

COB 2: To create swift programs in Xcode IDE.

COB 3: To develop simple iOS mobile applications.

THEORETICAL STUDY

MODULE I INTRODUCTION TO SWIFT 7

Swift - Basic Data Types – Strings and Characters – Operators – Functions – Collections – Control Flow and Looping – Structures and Classes

MODULE II ADVANCED SWIFT CONCEPTS & iOS BASICS 8

Concurrency – Storing Data with Core Data - Extending Classes – Advanced Data Types – Debugging – Swift Runtime - iOS Basics - iOS Architecture - Integrated development Tools

MODULE III iOS APPLICATION DEVELOPMENT 15

iOS Frame work and Libraries - Project templates - Resource & Application Settings - Views & Controls - Debugging & Running - Building Block Approach - Application Life cycle - MVC – Pattern - View - Data Management - Application Storage - Memory Management - UI Design -Design Tools - Interface Builders - Story board - View Controllers - Drawing model – Windows - Event Handling - View data Source and delegates

LABORATORY PRACTICE 30

- Developing Simple Swift programs (4 exercises)
- Mobile application development in iOS. (Students can select their own problem to develop an Application)

  ample Applications
  - Scientific calculator
  - Home Automation
  - Ecommerce App
  - Currency converter
  - Reminder
  - Games

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Matt Neuburg, “iOS 11 Programming Fundamentals with Swift”, O'Reilly Media, Inc. 2017.
2. Michael Dippery, “Professional iOS Programming with Swift”, Wiley, 2015.
3. Wei-Meng Lee, “Beginning Swift Programming”, Wrox, 2015.
4. Rob Napier, Mugunthkumar, “iOS 7 Programming”, Wiley, 2014.
5. Erica Sadun, “The iOS 5 Developer’s Cookbook”, Pearson, Third Edition, 2012.

COURSE OUTCOMES:

On completion of the course, students will be able to :

CO1: write simple programs using swift programming language.

CO2: use advanced concepts inswift programming and explain the basics of ios**.**

CO3: design and develop small iOS applications to solve the real-time problems.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

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

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

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

Statement: The knowledge of the Swift Programming leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 07	INTRODUCTION TO NOSQL DATABASE	L	T	P	C
SDG: 4		2	0	2	3

COURSE OUTCOMES:

CO1: To understand the different database generations and various data models in NoSQL.

CO2: To learn Key value database.

CO3: To understand the document oriented database.

CO4: To understand the columnar data model .

MODULE:1 INTRODUCTION TO NOSQL CONCEPTS 8

Data base revolutions: First generation, second generation, third generation, Managing Transactions and Data Integrity, ACID and BASE for reliable database transactions, Speeding performance by strategic use of RAM, SSD, and disk, Achieving horizontal scalability with Data base sharing, Brewers CAP theorem.

NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model: Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems.

MODULE: 2 KEY VALUE DATA STORES 7

From array to key value databases, Essential features of key value Databases, Properties ofkeys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Architecture and implementation Terms, Designing Structured Values, Limitations of KeyValue Databases, Design Patterns for Key-Value Databases, Case Study: Key-Value Databases for Mobile Application Configuration.

MODULE:3 DOCUMENT ORIENTED DATABASE 8

Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharing, Consistency Implementation: Distributed consistency, Eventual Consistency, Capped Collection, Case studies: document oriented database: Mongo DB and/or Cassandra

MODULE:4 COLUMNAR DATA MODEL 7

Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes, Indexing, Adaptive indexing and Database Cracking.

L – 30 ; P – 30 ; TOTAL HOURS – 60

REFERENCES :

1. Christopher D.manning, PrabhakarRaghavan, HinrichSchutze, An introduction to Information Retrieval, Cambridge University Press.
2. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of Modern Column-Oriented Database Systems, Now Publishers.

List of Experiments:

1. ImporttheHubwaydataintoNeo4jandconfigureNeo4j.Then, answer the following questions using the Cypher Query Language: a) List top 10 stations with most outbound trips (Show station name and number of trips) b) List top10 stations with most in bound trips (Show station name and number of trips) c) List top 5 routes with most trips (Show starting station name, ending station name and number of trips) (4) List the hour number(forexample13means1pm-2pm) and number of trips which startfrom the station ”B.U.Central” d) List the hour number(for example 13 means 1pm-2pm) and number of trips which end at the station ”B.U. Central”

2. Download a zip code dataset at http://media.mongodb.org/zips.json .Use mongo import to import the zip code dataset into Mongo DB. After importing the data, answer the following questions by using aggregation pipelines: (1) Find all the states that have a city called ”BOSTON”. Find all the states and cities whose names include the string ”BOST”. Each city has several zip codes. Find the city in each state with the most number of zip codes and rank those cities along with the states using the city populations. Mongo DB can query on spatial information.

3.Create a database that stores road cars. Cars have a manufacturer, a type. Each car has a maximum performance and a maximum torque value. Do the following: Test Cassandras replication schema and Consistency models.

4. Master Data Management using Neo4j Manage your master data more effectively The world of master data is changing. Data architects and application developers are swapping their relational databases with graph databases to store their master data. This switch enables them to use a data store optimized to discover new insights in existing data,providea360-degree view of master data and answer questions about data relationships in real time.

5. Shopping Mall case study using cassendra, where we have many customers ordering items from themall land we have suppliers who deliver them their ordered items.

COURSE OUTCOMES:

On completion of the course, students will be able to :

CO1: explain the fundamentals of NoSQL.
CO2: explain and use / implement key value data model.
CO3: explain and use / implement document oriented databases.
CO4: explain and use / implement columnar data model.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

Statement: The course provides flexible schemas and scale easily with large amounts of data and high user loads. NoSQL databases are used in nearly every industry like Health care and Modern application paradigms like micro-services and real-time streaming

.

ITDX08	COMPUTATIONAL INTELLIGENCE	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To provode a strong foundation on fundamental concepts in Computational Intellogence.

COB2: To enable problem solving through various searching techniques.

COB3: To apply these techniques in applications which invlve perception, reasoning and Learning

COB4: To napply Computational intelligence techniques for information retrieval.

COB5: To apply computational intelligence techniques primarily for machine learning.

MODULE I INTRODUCTION **9**

Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing- Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.

MODULE II KNOWLEDGE REPRESENTATION AND REASONING **9**

Proposition Logic – First Order Predicate Logic – Unification – Forward Chaining -Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information – Prolog Programming.

MODULE III UNCERTAINTY **9**

Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks-Neuro-fuzzy Inference.

MODULE IV LEARNING **9**

Probability basics – Bayes Rule and its Applications – Bayesian Networks – Exact and Approximate Inference in Bayesian Networks – Hidden Markov Models – Forms of Learning – Supervised Learning – Learning Decision Trees – Regression and Classification with Linear Models – Artificial Neural Networks – Nonparametric Models – Support Vector Machines – Statistical Learning – Learning with Complete Data – Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

MODULE V INTELLIGENCE AND APPLICATIONS **9**

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-AII applications – Language Models – Information Retrieval – Information Extraction – Machine Translation – Machine Learning – Symbol-Based – Machine Learning: Connectionist – Machine Learning.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, 'ArtificialmIntelligence: A Modern Approach", Fourth Edition, Pearson Education/Prentice Hall of India, 2020.
2. Elaine Rich and Kevinn Knight, "Artificial Intelligence"' Fourth Edition, Tata Mcgraw-Hill, 2020.

REFERENCES:

9. Patrick H.Winston, "Artfificial Intelligence", Fourth Edition, Pearson Education, 2020.
10. Dan W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI, 2010.
11. Nils J.Nilsson, "Artificial Intellogence:"A new symthesis", Harcourt Asia Private Ltd, 2000

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1: Provide a basic exposition to the goals and methods of computational intelligence.

CO2:explain of the design of intelligent computational techniques.

CO3: Apply the intelligent techniques for problem solving

CO4: Improve problem solving skills using the acquired knowledge in the areas of reasoning

CO5: Apply the computational intelligence techniques for machine learning.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	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
CO 1	L	L	L										L	L
CO 2	L	L	H										L	L
CO 3	L	H	L										L	L
CO 4	M	M	M										L	L
CO 5	L	H	L										L	L

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

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

Statement: The knowledge of the ComputationalIntelligence leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 09	NATURAL LANGUAGE PROCESSING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To Learn the techniques in natural language processing.

COB2: To be familiar with the natural language generation.

COB3: To be exposed to machine translation.

COB4: To Understand the information retrieval techniques.

COB5: To apply theinformation retrieval techniques in the real world

MODULE I OVERVIEW AND LANGUAGE MODELING 9

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

MODULE II WORD LEVEL AND SYNTACTIC ANALYSIS 9

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.

MODULE III SYNTACTIC ANALYSIS AND SEMANTIC ANALYSIS 9

Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing. Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation.

MODULE IV MACHINE TRANSLATION AND INFORMATION RETRIEVAL 9

Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

MODULE V LEXICAL RESOURCES AND APPLICATIONS 9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net-Stemmers-POS Tagger- Research Corpora - Applications.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

REFERENCES:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2 nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin /Cummings publishing company, 1995.

COURSE OUTCOMES:

CO1: Discuss the major trends and systems in Natural Language Processing.

CO2: Explain context free grammars and the use of parsers.

CO3: Outline the syntax of grammars and analyze the feature-based semantic systems.

CO4: Apply statistical techniques to natural language analysis.

CO5: Do machine translation.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L				L						M			M	
CO2		M												M	
CO3		H						M							
CO4	L			M		L				M					
CO5			L							H					

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

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

Statement : The problem solving methodologies of Natural Language Processing helps to solve and predict the problems associated with any engineering domain and provides appreciable solution to real world problems.

ITDX 10	C# and .NET FRAMEWORK	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

The students will:

COB1: know the object oriented aspects of C#.

COB2: learn the technologies of the .NET framework and web application development in .NET.

CO3: learn web based applications on .NET (ASP.NET).

MODULE I OBJECT ORIENTED ASPECTS OF C# 12

Introduction to C# - Overview of .NET Framework –Basic Elements of C# - Inheritance - Namespace – Polymorphism – Interface and Overloading – Multiple Inheritance – Property – Indexes – Delegates – Publish/Subscribe Design Patterns- Operator Overloading-Method Overloading- File Operation- Stream Oriented Operations- Multithreading – Thread Operation.

MODULE II .NET AND WEB SERVICES 10

Working with XML – Techniques for Reading and Writing XML Data - Using XPath and Search XML - ADO.NET Architecture – ADO.NET Connected and Disconnected Models – XML and ADO.NET – Simple and Complex Data Binding– Data Grid View Class, Web Services -Building an XML Web Service - Web Service Client – WSDL and SOAP.

MODULE III APPLICATION DEVELOPMENT ON .NET 8

Application Domains – Remoting – Leasing and Sponsorship - .NET Coding Design Guidelines –Assemblies – Security – Application Development.

PRACTICALS 30

LIST OF EXPERIMENTS

1. Programs using I/O Operations
2. Programs using Operators, Expressions and Statements
3. Programs using conditional statements & loops
4. Program using Inheritance and overloading
5. Program using exception handling
6. Create application using Windows Forms & CSS
7. Create application using Web Forms
8. Develop web service applications: chat, email, e-banking & e-shopping
9. Program to access data source through ADO.NET.

L – 30 ; P –30 ; TOTAL HOURS –60

TEXT BOOKS:

1. KamleshPadaliya and Dr. Ashutosh Kumar Bhatt , “C # Programming with .Net Framework (English, Paperback,), Bharti Publications, 2016.
2. Marino Posadas, “Mastering C# and .Net Framework”, Kindle Edition, 2016.
3. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012.

REFERENCES:

1. Stephen C. Perry “Core C# and .NET”, Pearson Education, 2006.
2. S. ThamaraiSelvi and R. Murugesan “A Textbook on C# “, Pearson Education, 2003.
3. Jesse Liberty, “Programming C#”, Second Edition, O’Reilly Press, 2002.
4. Thuan L &Thai Hoang Lam, “.Net Framework Essentials”, 2nd edition, O’Reilly publications, 2002
5. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1:List the major elements of the .NET frame work and discuss CLR.

CO2: Explain how C# fits into the .NET platform.

CO3: Analyze the basic structure of a C# application.

CO4: Debug, compile, and run a simple application.

CO5: Develop programs using C# on .NET

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1					1	1	1	3	2
CO2	3	3	3	2	2					1	1	1	3	2
CO3	3	3	2	2	2					1	1	1	3	2
CO4	3	3	2	2	2					1	1	1	3	2
CO5	3	3	2	2	2					1	1	1	2	2

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

Statement: The proper learning of C# and .Net Framework leads to inclusive and sustainable economic growth, full and productive employment for the students.

SEMESTER VI

ITDX 11	INTRODUCTION TO DEVOPS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamental concepts of DevOps

COB2: To gain knowledge on collaboration in DevOps

COB3: To understand how to work along with team

COB4: To acquire knowledge in DevOps tools

COB5: To learn scaling and bridging in DevOps

MODULE I INTRODUCTION 9

Introduction - The Devops Equation - Foundational Terminology and Concepts - Devops Misconceptions and Anti-Patterns - The Four Pillars of Effective Devops.

MODULE II COLLABORATION 9

Defining Collaboration - Individual Differences and Backgrounds - Opportunities for Competitive Advantage – Mentorship - Mindsets - Reviews and Rankings - Communication and Conflict Resolution Styles - Empathy and Trust - Humane Staffing and Resources - Effective Collaboration with Sparkle Corp - Collaboration Misconceptions - Collaboration Troubleshooting.

MODULE III AFFINITY 9

Sparkle Corp Development – People Networks – Team - Case Study – Benefits – Requirements – Measurement - Affinity Misconceptions - Affinity Troubleshooting.

MODULE IV TOOLS 9

Tools: Ecosystem Overview - Software Development – Automation – Monitoring - Accelerators of Culture - Tools Misconceptions - Tools Troubleshooting.

MODULE V SCALING AND BRIDGING 9

Scaling: Inflection Points - Misconceptions and Troubleshooting - Building Bridges with the Four Pillars of Effective Devops - Bridging Devops Cultures: Learning from Our Stories - Bridging Devops Cultures: Fostering Human Connections

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Jennifer Davis & Katherine Daniels, "Effective DevOps", O'Reilly Media, Inc., 2016.

REFERENCES:

1. Nicole Forsgren, Jez Humble, and Gene Kim, "Accelerate: Building and Scaling High Performance Technology Organizations", IT Revolution Press, 2018
2. Sanjeev Sharma, "The DevOps Adoption Playbook", John Wiley & Sons, Inc., 2017

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: explainDevOps fundamental concepts

CO2: describe about collaboration in DevOps

CO3: develop software in collaboration with team members

CO4: choose suitable tools for software development

CO5: develop a successful product from the scratch

CO6: bridging thegap between development and operations

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	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												M	
CO2	M												M	
CO3	M												M	
CO4					M									M
CO5													M	
CO6													M	

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

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

Statement: By learning the concepts of DevOps, the students are able to apply the concepts to build real time projects which can add to productive employment

ITDX 12	E-COMMERCE AND DIGITAL MARKETING	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: Understand the various nuances of digital marketing such as SEO, SMM, e-mail marketing.

COB2: Create the right content and campaigns for different target groups.

COB3: Develop an understanding of the current practices and Opportunities in e-shopping, e-distribution and e-collaboration.

COB4: Explore several issues surrounding e-business such as security, authentication, privacy and intellectual Property regulations.

MODULE I ECOMMERCE AND DIGITAL MARKETING **9**

Ecommerce- Digital Marketing-How Digital Marketing and Ecommerce Interlinked-Market and Customers-Emerging Trends-Opportunities and Challenges-Benefits of e-commerce and Digital Marketing.

MODULE II DIGITAL BUSINESS MODEL **9**

B2B (MRO Hubs, Catalogue Hubs, Yield Managers, Exchanges)- B2C (Portal, Storefront, Content Provider, Service Provider, Transaction Broker, Community Provider, Market Creator)-C2C.

MODULE III PRODUCT/SERVICES **9**

Choose the Pain Area-Find your Product/Service Scalability-Define your Customer.

MODULE IV TOOLS AND TECHNIQUES OF EBUSINESS **9**

Technology and Internet Requirements-Web based Market Research-Choosing a Domain Name-Understanding Site Design-Low-Cost Web Development-Best Hosting Service-Creating content for your website-Publishing Your Ecommerce Webstore Online.

MODULE V SOCIAL MEDIA MARKETING **9**

Face book Business Marketing- Instagram Business Marketing-Quora Marketing-Twitter Business Marketing-LinkedIn Business Marketing-video marketing.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Turban, Efraim, and David King, “Electronic Commerce: A Managerial

Perspective", 2010, Pearson Education Asia, Delhi.
2. Kalakota, Ravi, "Frontiers of Electronic Commerce", 2004, Addison – Wesley, Delhi.

REFERENCES:

1. Rayport, Jeffrey F. and Jaworksi, Bernard J, "Introduction to E–Commerce", 2003,
2. SmanthaShurety, "E–Business with Net Commerce", Addison – Wesley, Singapore,

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1: Explain the foundations and importance of E-Commerce

CO2: Demonstrate an understanding of the impact of eCommerce on business models and strategy

CO3: Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.

CO4: Describe the infrastructure for ECommerce

CO5: Demonstrate an understanding of eCommerce related programming, database, and networking issues.

CO6: Recognize legal, global, privacy, security and risk management issues in Ecommerce

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2	1					2	3		1	1
CO2	2	2	3	3	1					1	3		1	1
CO3	3	2	3	2	1					1	3		1	1
CO4	1	1	1										1	1
CO5	3	1	1	1	1								1	1
CO6	3	3	3	3	2					2	2		2	2

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

SDG4:Ensuring inclusive and equitable quality education for all personsand promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to provide all-inclusive and thorough knowledge about E-Commerce and Digital marketing.

ITDX 13	PRINICPLES OF COMPILER DESIGN	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Enrich the knowledge in various phases of compiler.

COB2: Design and construct a lexical analyzer.

COB3: Expand the knowledge of parser by parsing.

COB4: Construct the syntax-directed tress.

COB5: Concise and design optimization of codes.

MODULE I INTRODUCTION 9

Language processor - Structure of a Compiler - Applications of Compiler Technology - Programming language basics - Syntax Definition - Syntax-Directed translation - parsing - Lexical Analysis - symbol tables - intermediate code generation.

MODULE II LEXICAL ANALYSIS 9

The role of lexical analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens - Lexical Analyzers generator Lex, Finite Automata - From a Regular Expression to automata - Design of a Lexical Analyzer Generator.

MODULE III SYNTAX ANALYSIS 9

Introduction - Context Free Grammars -Top Down parsing - Bottom-up Parsing - Introduction to LR parsing - Construction of SLR Parsing table - Introduction to LALR Parser- Parser Generators.

MODULE IV SYNTAX - DIRECTED TRANSLATION 9

Syntax-Directed Definitions - Construction of Syntax Trees - Syntax-Directed Translation schemes - Implementing L-Attributed SDD's.

MODULE V INTERMEDIATE CODE GENERATION 9

Variants of syntax trees - Three-address code - Types and declarations - Translation of Expressions - Type checking - Type Conversions - Control Flow- code generator - Peephole Optimization- Optimal code generation.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Alfred V.Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman, "Compilers - Principles, Techniques and Tools", Second edition, Pearson Education, New Delhi, 2013.

REFERENCES:

1. Raghavan V, “Principles of Compiler Design”, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009.
2. Dick Grone, Henri E Bal, Ceriel J H Jacobs and Koen G Langendoen, “Modern Compiler Design”, John Wiley, New Delhi, 2016.
3. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers, 2015.
4. Dhamdhere D M, "Compiler Construction Principles and Practice", second edition, Macmillan India Ltd., New Delhi, 2002.
5. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", McGraw Hill, New Delhi, 2005.

COURSE OUTCOMES:

CO1: Explain the concepts and different phases of compilation with compile
Time error handling.

CO2: Represent language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a Language.

CO3: Compare top down with bottom up parsers, and develop appropriate Parser to produce parses tree representation of the input.

CO4: Generate intermediate code for statements in high level language.

CO5: Design syntax directed translation schemes for a given context free Grammar.

CO6: Apply optimization techniques to intermediate code and generate Machine code for high level language program.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	H	H		H		M	M	M	M	H	H
CO2	H	M	H	H	M		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	H	H
CO4	H	M	H	H	M		H		M	M	M	M	H	H
CO5	H	H	M	M	L		H		H	M	M	H	M	H
CO6	H	H	M	H	M		H		H	H	H	M	H	H

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

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

The modules and topics of this course are designed to ensure all inclusive and through knowledge about Principles of compiler design.

SEMESTER VII

ITDX 14	**VIRTUAL REALITY**	**L**	**T**	**P**	**C**
SDG: 4		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

The students will:

COB1: impart the fundamental aspects and principles of virtual reality technologies.

COB2: know the internals of the hardware and software components involved in the development of virtual reality enabled applications.

COB3: learn about the human visual and auditory systems.

COB4: gain knowledge about virtual reality application development.

COB5: learn how to evaluate the virtual reality based applications.

MODULE I INTRODUCTION TO VIRTUAL REALITY (VR) 11

Goals and VR definitions – Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics –-Benefits of Virtual Reality – Components of VR System – Mixed Reality - Introduction to Augmented Reality (AR) – System Structure of AR – Key Technology in AR – 3D Vision –Input Devices – 3D Position Trackers Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System –Human Auditory System.

MODULE II VR PROGRAMMING 10

Introduction to VRML (Virtual Reality Modeling Language), Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of World Toolkit and Java 3D – GHOST – People Shop – Human Factors in VR – Methodology And Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding – Trajectories through Mixed Reality Performance – Mobile Interface Design – Quantitative Evaluation – Qualitative Evaluation.

MODULE III APPLICATIONS OF VR 9

Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization –Wearable Computing – Games.

PRACTICALS

LIST OF EXPERIMENTS

1. Write a program in VRML to draw a box with desired size and colour.
2. Write a program in VRML to draw a house like structure combines different shapes like Cone, Cylinder, and Box.
3. Write a program in VRML to draw the given design.
4. Develop an Applications of VR in Manufacturing
5. Develop an Applications of VR in Robotics
6. Develop an applications of VR in Information Visualization
7. Develop an applications of VR in Wearable Computing
8. Develop an interactive 2D/3D games using VR concepts
9. Develop Interactive Multi-player games.

L – 30 ; P –30 ; TOTAL HOURS –60

TEXT BOOKS:

1. Grigore C. Burdea, Philip Coiffet, “Virtual Reality Technology”, Second Edition, Wiley India, 2006.
2. Benford, S., Giannachi G., “Performing Mixed Reality”, MIT Press, 2011
3. John Vince, “Virtual Reality Systems”, Pearson Education, First edition, 2007.

REFERENCES:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile”, Packt Publisher, 2018.
2. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
3. William R. Sherman, Alan B.Craig: “Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003.
4. Burdea, G.C. and P. Coiffet, “Virtual Reality Technology”, Second edition, Wiley-IEEE Press, 2003.
5. Alan B. Craig, William R. Sherman, and Jeffrey D. Will, “Developing Virtual Reality Applications-Foundations of Effective Design”, Morgan Kaufmann, Publisher, 2012.
6. Peter Shirley, Michael Ashikhmin, and Steve Marschner, “Fundamentals of Computer Graphics”, A K Peters/CRC Press; Third edition, 2009.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Discuss the basic concepts of virtual Reality.

CO2: Design and develop the Virtual Reality applications in different domains.

CO3: Design various models using modeling techniques.

CO4: Perform Mixed Reality Programming with toolkits.

CO5: Understand the working principles of input output devices used in virtual reality applications.

CO6: Evaluate virtual reality based applications.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1		M								L				L
CO2			M	L									M	H
CO3			M	L			M						M	H
CO4					M									L
CO5		L												M
CO6					M								M	

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

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

Statement: Students of both male and female are given Virtual Reality (VR) programming skills needed for designing VR applications. This will substantially increase the number of students who have relevant technical skills in VRML, World Toolkit, Java 3D, GHOST and People Shop etc., for employment, decent job and entrepreneurship.

ITDX 15	SOFTWARE QUALITY MANAGEMENT	L	T	P	C
SDG : 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the fundamental concepts of quality management.

COB2: To acquire the knowledge of understanding the "widely-used" quality analysis tools and techniques.

COB3: To have the exposure about software quality assurance, quality measures, and quality control.

COB4: To introduce philosophies and strategies to quality related issues.

MODULE I SOFTWARE QUALITY ASSURANCE 9

Quality Concepts and Perspectives - Assuring Software Quality Assurance – Software Quality Assurance Planning.

MODULE II SOFTWARE QUALITY MEASUREMENTS 9

Fundamentals Of Measurement Theory – Software Quality Metrics Overview – Applying The Seven Basic Quality Tools In Software Development – Selecting Quality Goals And Measures – Principles Of Measurement – Measures And Metrics – Quality Function Deployment – Measuring And Analyzing Customer Satisfaction.

MODULE III SOFTWARE QUALITY MANAGEMENT MODELS 9

Quality Management Systems – A Historical Perspective, A QMS For Software – Quality Management Systems – The ISO 9000 Series Of Quality Management Standards – Models And Standards For Process Improvement – Dos And Don’ts Of Software Process Improvement.

MODULE IV SOFTWARE QUALITY METRICS 9

Product Quality Metrics: Defect Density-Customer Problems Metric-CustomerSatisfaction Metrics-Function Points- In-Process Quality Metrics: Defect Arrival Pattern-Phase-Based Defect Removal Pattern- Defect Removal Effectiveness-Metrics for Software Maintenance: Backlog Management Index- Fix Response Time- Fix Quality-Software Quality Indicators.

MODULE V SOFTWARE MANAGEMENT PROCESS FRAMEWORK & DISCIPLINE **9**

Life Cycle Process – Model Based Software Architectures – Workflow of The Process – Checkpoint of The Process – Iterative Process Planning – Project Organizations And Responsibilities – Process Automation.

L – 45 ; TOTAL HOURS – 45

TEXT BOOK:

1. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, 2016.

REFERENCES:

1.Gordon G Schulmeyer, “Handbook of Software Quality Assurance”, 4th Edition,Artech House Publishers, 2008.

2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, 2nd Edition, Pearson Edition, India, 2004.

3. Alan C. Gillies, “Software Quality Theory and Management”, 2nd Edition, Thomson Press, 2003.

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

CO1: Describe software quality assurance.

CO2: Understand the measurement theory concept

CO3: Choose the suitable software quality model for the given software project.

CO4: Identify various software quality metrics

CO5: Understand management problems, general solutions, technologies and standards.

CO6: Describe software process improvement

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	H	H	H		H		M	M	M	M	H	H
CO2	H	M	H	H	H		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	H	H
CO4	H	M	H	H	M		H		M	M	M	M	H	H
CO5	H	H	M	M	M		H		H	.H	H	H	H	H
CO6	H	H	H	H	M		H		H	H	H	M	H	H

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

SDG4:Ensuringinclusiveandequitablequalityeducationforallpersonsandpromotelifelonglearningopportunities.

Statement: The modules and topics mentioned in this course are designed toensure all-inclusive and thorough knowledge about software quality management.

ITDX 16	ENTERPRISE RESOURCEPLANNING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Knowing the real time information about business field strategies and business process of an Enterprise.

COB2: Understand and how to access information and provide services through an intuitive and integrated Interface.

COB3: To understand the key implementation issues.

COB4: To know the business modules and appreciate the Currentand future trends.

COB5: To be aware of some popular products available inMarket.

MODULE I ERP AND TECHNOLOGY 9

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR),DataWarehousing, Data Mining, OLAP, SCM, CRM and Product life Cycle management.

MODULE II ERP IMPLEMENTATION 9

ERP Implementation Challenges - Lifecycle, Implementation Methodology, Package selection, Requirements Definition – Methodologies -Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Data Migration, Project Management and Monitoring.

MODULE III ERP IN ACTION 9

Operation and Maintenance of the ERP System, Measuring the Performance of the ERP System, Maximizing the ERP System.

MODULE IV THE BUSINESS MODULES 9

Business modules in an ERP Package, Finance, Manufacturing, Human Resources, Materials Management, Marketing, Total Quality Management, Sales, Distribution and Service.

MODULE V THE ERP MARKET 9

Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc –SSA Global – Lawson Software- ERP II, ERP and Internet, Future Directions and Trends in ERP.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. AlexisLeon,"ERPDemystified",TataMcGrawHill,NewDelhi,200
2. Mary Sumner, "Enterprise Resource Planning", Pearson Education, 2007

REFERENCES:

1. Vinod Kumar Garg and Venkitakrishnan NK, "Enterprise Resource Planning– Concepts and Practice", PHI, New Delhi,2003.
2. JosephABrady, EllenFMonk, BretWagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA,2001.

COURSE OUTCOMES:

CO1: Understand how business processes are mapped(translated) into enterprise system software and how managerial decisions integrate across disciplines.

CO2: Understand and be able to articulate the life cycle stages of any ERP Implementation.

CO3: Develop working knowledge of enterprise system modules to enable

Efficient navigation and information access for management.

CO4: Differentiate enterprise system transactions, queries, and reports within a manager's role and develop competence in transforming Raw data into management information.

CO5 : Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP Products and development methods.

CO6: Design and implement ERP Strategies.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	H	H		H		H	H	H	H	H	H
CO2	M	M	M	H	M		H		M	M	M	H	H	H
CO3	H	M	H	H	M		H		M	M	M	H	H	H
CO4	M	M	H	H	M		H		M	M	M	H	H	H
CO5	M	H	M	M	L		H		H	M	M	H	M	H
CO6	H	H	M	H	M		H		H	H	H	M	H	H

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

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

The modules and topics of this course are designed to ensure all inclusive and through knowledge about Enterprise Resource Planning.

ITDX 17	AGILE METHODOLOGIES	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand different software process models, roles and responsibilities.

COB2: To acquire knowledge in design

COB3: To be familiar on software development concepts

COB4: To learn various testing techniques

MODULE I INTRODUCTION 7

Introduction - Software Products and Ideas Behind Them - Different Models - Roles, Responsibilities, and Methodologies.

MODULE II SCRUM 9

Kanban – Scrum Essential – Scrum Day by Day – Agile in the Organization – Support – Mechanism – A Call to Action.

MODULE III EXTREME PROGRAMMING 9

The Primary Practices of XP - The XP Values Help the Team Change Their Mindset - An Effective Mindset Starts with the XP Values - Understanding the XP Principles Helps You Embrace Change - XP, Simplicity, and Incremental Design.

MODULE V TESTING 10

Lean Thinking - Creating Heroes and Magical Thinking - Eliminate Waste - Gain a Deeper Understanding of the Product – Fast Delivery – The Agile Coach.

MODULE V MAINTENANCE 9

Maintaining and Improving Your Software - Wrapping Up With Some Tips and Tricks - Development Tips - Frameworks - Code Style Guidelines - Code Style Guidelines - Code Reviews and Pair Programming - Quality Assurance Tips - DevOps Tips - Project and Product Management Tips - Time Management Tips - Team Management Tips.

L –45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Olga Filipova and RuiVilão, “Software Development From A to Z: A

Deep Dive into all the Roles Involved in the Creation of Software", Apress Publishers, 2018.
2. Andrew Stellman and Jennifer Greene, "Learning Agile", O'reilly, 2021.

REFERENCES:

1. Ivan Lukovic and Yen Ying Ng, "Lean and Agile Software Development, 6th International Conference, Springer, 2022.
2. Paul Flewelling , "The Agile Developer's Handbook", Packt Publishing Limited, 2018
3. SudiptaMalakar, "AGILE in Practice: Practical Use-cases on Project Management Methods including Agile, Kanban and Scrum", BPB Publications , 2021.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: explain different software process models, roles and responsibilities.

CO2: design a software for the given requirements

CO3: describe frontend and backend development concept

CO4: develop a software

CO5: apply various testing techniques for the given software

CO6: describe various tips for maintaining the software

Board of Studies (BoS) : 16thBoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	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													M
CO2			M										M	
CO3					M									M
CO4					M									M
CO5					M									M
CO6		M												

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

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

Statement : The proper learning of the Agile Methodologies leads to develop software for the business requirements and engineering problems and this will support the students to get employment.

ITDX 18	GAME THEORY	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

The students will:

COB1: get introduced to the fundamental concepts of game design and development.

COB2: learn the underlying theory of 2D and 3D Computer Graphics principles and algorithms for game design.

COB3: learn the processes, mechanics, issues in game design.

COB4: understand the architecture of game engines.

COB5: develop and implement simple games using standard APIs.

MODULE I INTRODUCTION 9

Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

MODULE II 3D GRAPHICS FOR GAME PROGRAMMING 9

Game Programming Fundamentals - C++ - Java - Scripting Languages, Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces.

MODULE III GAME DESIGN PRINCIPLES 9

Balancing, Core mechanics, Creating the Game World-Principles of level design, Computer Interface Design-Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris.

MODULE IV GAMING ENGINE DESIGN 9

Game Engine Architecture, Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims.

MODULE V GAME DEVELOPMENT & BUSINESS OF GAMES 9

Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games, Case Study: Mine craft-Games industry role-Economics -Publisher-Developer relationship – Marketing.

L – 45; TOTAL HOURS –45

TEXT BOOKS:

1. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", Second Edition, Morgan Kaufmann, 2010.
2. Jung Hyun Han, "3D Graphics for Game Programming", First Edition, Chapman and Hall/CRC, 2011.
3. M. J. Osborne, "An Introduction to Game Theory". Oxford University Press, 2004.
4. Jason Gregory, "Game Engine Architecture", CRC Press, Third Edition, 2018.

REFERENCES:

1. Jonathan S. Harbour, "Beginning Game Programming", Course Technology, Third Edition PTR,2009.
2. Ernest Adams, "Fundamentals of Game Design", Third Edition, Pearson Education, 2015.
3. Scott Rogers, "Level Up: The Guide to Great Video Game Design‖,FirstEdition,Wiley,2010.
4. Jim Thompson, Barna by Berbank-Green, and NicCusworth,\ "Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer", First Edition, Wiley, 2008. .
5. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, "Algorithmic Game Theory", Cambridge University Press, 2007.
6. Jeannie Novak, "Game Development Essentials - An Introduction", 3rd Edition, Delmar Cengage Learning, 2011.
7. M. J. Osborne, "An Introduction to Game Theory". Oxford University Press, 2004.
8. https://unity3d.com/ 4. https://www.pygame.org/

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Understand the essential elements of Game Design and Game Play.

CO2: Understand the Core Concepts of Graphics for Game Design and Development.

CO3: Familiarize oneself with Game Design Principles and process.

CO4: Understand the essential components of Game Engine for Designing and Developing Games.

CO5: Develop Interactive 2D/3D Games.
CO6: Develop Interactive Multi-player games.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	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												L
CO2		M												M
CO3		L												M
CO4		H												L
CO5			M										M	
CO6			M										M	

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

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

Statement: Students of both male and female are given game programming skills needed for game designing. This will substantially increase the number of students who have relevant technical skills in JavaScript, 3D graphics, Game AI, OpenGL, DirectX etc., for employment, decent job and entrepreneurship.

ITDX 19	FUNCTIONAL PROGRAMMING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: Learn the concepts of functional programming using Java

COB2: Understand the differences between imperative and declarative style of programming

COB3: Understand higher order functions, pure functions, handling errors and exceptions

COB4: Solving real world problems

MODULE I INTRODUCTION TO FUNCTIONAL PROGRAMMING 9

Introduction, Programs without side-effects, Benefits, Functions in Java, Advanced Function Features, Java functional features, Debugging with Lambdas, Making Control Structures Functional, Abstracting Control Structures, Abstracting Iteration, Using Right Types.

MODULE II RECURSION, CORECURSION, MEMOIZATION, AND DATA HANDLING 9

Understanding corecursion and recursion, Working with recursive functions, Composing a huge number of functions, Using memorization, Classifying data collections, An immutable, persistent, singly linked list implementation, Data sharing in list operations, Using recursion to fold lists with higher-order functions, Problems with the null pointer, Alternatives to null references, The Option data type, Miscellaneous utilities of Option, How and when to use Option.

MODULE III HANDLING ERRORS AND EXCEPTIONS, ADVANCED LIST HANDLING, LAZINESS 9

The problems to be solved, The Either type, The Result type, Result patterns, Advanced Result handling, The problem with length, Composing List and Result, Abstracting common List use cases, Automatic parallel processing of lists, Understanding strictness and laziness, Implementing laziness, Things you can’t do without laziness, Why not use the Java 8 Stream?, Creating a lazy list data structure, The true essence of laziness, Handling infinite streams, Essence of laziness, Handling infinite streams, Avoiding null references and mutable fields.

MODULE IV DATA HANDLING WITH TREES, ADVANCED TREES, STATE MUTATION 9

Binary Tree, Implementing Binary Search Tree, Removing Elements, Merging, Folding, Mapping, Balancing, Better performance and stack safety with self-balancing trees, A use case for the red-black tree: maps, Implementing a functional priority queue, A priority queue for noncomparable elements, A functional random number generator, A generic API for handling state, Generic state handling.

MODULE V FUNCTIONAL I/O, SHARING MUTABLE STATE, SOLVING COMMON PROBLEMS 9

Applying effects in context, Reading data, Really functional I/O, The Actor Model, Building the actor framework, Putting actors to work, Using assertions to validate data, Reading properties from file, Converting an imperative program: the XML reader.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Pierre-Yves Saumont, “Functional Programming in Java”, Manning Publications, 2017

REFERENCES:

1. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, “Modern Java in Action”, Manning Publications, 2019.
2. Neal Ford, “Functional Thinking “, O’Reilly Media, Inc., 2014.
3. Joshua Backfield, “Becoming Functional”, O’Reilly Media, Inc., 2014.
4. John Paul Mueller, “Functional Programming For Dummies”, John Wiley & Sons, Inc., 2019.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: realize the functional programming concept

CO2: describe the preference declarative programming over imperative style

CO3: describe error handling approaches

CO4: explain data handling and state mutation

CO5: explain the functional support in Java programming language

CO6: use functional programming in real world applications

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M													M
CO2	M													M
CO3	M													M
CO4					M									M
CO5					M									M
CO6													M	

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

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

Statement: The proper learning of the functional programming concepts leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 20	FULL STACK WEB DEVELOPMENT	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

1. Understand the core concepts of HTML, CSS, and JavaScript to develop static and interactive web pages.
2. Gain proficiency in frontend and backend development, enabling students to design and implement full-stack web applications.
3. Familiarize with modern web development practices and tools, preparing them for industry standards.
4. Equip students with the knowledge and skills to deploy web applications to production environments and ensure scalability.

MODULE I Introduction to Web Development 7

Introduction to HTML, CSS, and JavaScript - Building basic web pages with HTML and styling them with CSS -Introduction to JavaScript and its use in enhancing web pages

MODULE II Frontend Development 7

Advanced HTML5 and CSS3 features - Responsive web design principles - Introduction to frontend frameworks like Bootstrap or Tailwind CSS - Introduction to JavaScript frameworks/libraries like React or Vue.js

MODULE III Backend Development 8

Introduction to backend development using Node.js - Server-side programming with Node.js and Express.js - Database fundamentals (SQL/NoSQL) - Building RESTful APIs

MODULE IV Full Stack Development and Deployment 8

Integrating frontend and backend components - Authentication and authorization mechanisms - Deployment strategies for web applications - Introduction to cloud services like AWS / Firebase

Practical:

Exercises on the following topics:

1. Creating a simple static webpage
2. Styling the webpage using CSS
3. Adding interactivity using JavaScript
4. Building a responsive webpage

5. Implementing a frontend framework in a project
6. Building a simple React/Vue.js application
7. Creating a basic Node.js server
8. Implementing CRUD operations with a database
9. Building RESTful APIs
10. Integrating frontend and backend in a project
11. Implementing user authentication
12. Deploying a web application to a cloud platform

L – 30; P – 30; TOTAL HOURS – 45

TEXT BOOKS:

1. Jon Duckett, “HTML and CSS: Design and Build Websites”, 1st Edition, Wiley, 2011.
2. Jon Duckett, “JavaScript and JQuery: Interactive Front-End Web Development”, 1st Edition, Wiley, 2014.
3. Jennifer Niederst Robbins, “Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics”, 5th Edition, Shroff/O'Reilly, 2018.
4. ArtemijFedosejev, “React.js Essentials”, 1st edition, Packt Publishing, 2015.
1. David Herron, “Node.js Web Development”, 3rd Edition, Packt Publishing, 2016.

REFERENCES:

1. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, “MongoDB: The Definitive Guide”, 3rd Edition, O’Reilly, 2019.
2. ShamaHoque, “Full-Stack React Projects”, 2nd Edition, Packt Publishing, 2020.
3. Ben Piper, David Clinton, “AWS Certified Solutions Architect Study Guide”, 2nd Edition, Sybex Publishers, 2019.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO 1 Create static web pages incorporating HTML, CSS, and JavaScript.

CO 2 Design and develop responsive web applications that adapt to different screen sizes and devices.

CO 3 Perform CRUD (Create, Read, Update, Delete) operations on a database using Node.js and Express.js.

CO 4 Integrate frontend and backend components to build a complete full-stack web application.

Board of Studies (BoS) : 19th BoS of IT held on:22.5.202

Academic Council: 22nd AC Meeting held on 4.9.2024

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

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

SDG 13: Decent work and economic growth

Statement: The IT Engineers have a key role to play in promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

ITDX 21	UI AND UX DESIGN	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

1. To understand the need for UI and UX
2. To learn UI design principles and techniques
3. To explore the various tools used in UI & UX design
4. To explore the user experience in UI design
5. To study the advanced topics in UI & UX design

MODULE I Foundations of Design **7**

Introduction to UI and UX - History and evolution of UI and UX design - Principles of good design - User-centered design process - Design thinking methodology- Core Stages of Design Thinking - Divergent and Convergent - Thinking - Brainstorming and Game storming - Observational Empathy.

MODULE II UI Design Principles and Techniques **8**

Visual design principles (color theory, typography, layout) - UI design patterns and componentsWireframing and prototyping - Tools for UI design (Sketch, Figma, Adobe XD) –Accessibility and inclusive design.

MODULE III User Experience Design **8**

Introduction to User Experience - Why You Should Care about User Experience -Understanding User Experience - Defining the UX Design Process and itsMethodology - Research in User Experience Design - Tools and Method used forResearch- User Needs and its Goals - Know about Business Goals.

MODULE IV Advanced Topics in UI & UX design **7**

Designing for mobile and responsive interfaces - UX design for emerging technologies (AR, VR, AI) - UI and UX in different industries (e-commerce, healthcare, etc.) – Future trends in UI and UX design - Career paths and professional development in UI and UX design.

Practical:

List of Experiments:

1. Designing a Responsive layout for a societal application
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wire flow diagram for application using open-source software
5. Exploring various open-source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Brainstorming feature for proposed product
8. Defining the Look and Feel of the new Project
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colours based on UI principles)
10. Identify a customer problem to solve
11. Conduct end-to-end user research User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements.

L – 30; P – 30; TOTAL HOURS – 45

TEXT BOOK:

1. Designing with the Mind in Mind, Simple Guide to Understanding User Interface Design Guidelines, Jeff Johnson, Elsevier, 2014.

REFERENCES:

1. The Elements of User Experience: User-Centered Design for the Web and Beyond (2nd Edition) (Voices That Matter) 2nd Edition, Jesse James Garrett (Author), New Riders, 2010.
2. Designing Web Interfaces: Principles and Patterns for Rich Interactions 1st Editionby Bill Scott (Author), Theresa Neil (Author), O'Reilly Media, 2009.
3. Project Guide to UX Design, A: For user experience designers in the field or in the making (Voices That Matter), by Russ Unger (Author), Carolyn Chandler, 2nd Edition, Kindle Edition, New

Riders, 2012.

COURSE OUTCOMES:

On completion of the course, the students will be able to

CO1: Explain the design thinking methodology

CO2: Apply design principles and techniques for good design

CO3: Create a wireframe and prototype

CO4: Develop UI & UX design with user experience

CO5: Develop UI & UX design for real time applications

Board of Studies (BoS) : 19th BoS of IT held on:22.5.2024

Academic Council: 22nd AC Meeting held on 4.9.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M												M
CO2	M	H	M	M	M	H							H	M
CO3	M	M	M	M	H									M
CO4	M	M	H										H	
CO5	M	M	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 proper learning of UI & UX Design leads to inclusive and sustainable economic growth and productive employment for the students.

SPECIALIZATION II
IOT & DATA COMMUNICATION NETWORK

SEMESTER IV

ITDX 26	**PRINCIPLES OF COMMUNICATION**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The students will

COB1: understand the basics of communication.

COB2: gain an understanding of modulation and demodulation techniques.

COB3: learn the importance of digital communication.

COB4: understand the various satellite communication systems.

COB5: acquire knowledge about spread spectrum techniques.

MODULE I AMPLITUDE MODULATOR AND DEMODULATOR 9

Amplitude modulation concept – Modulation index and percent modulation – sidebands and the Frequency domain – Frequency domain representation of AM - AM power – Single sideband modulation - Signal power consideration - AM modulators - low level AM modulator - high level AM modulator – Amplitude demodulators.

MODULE II FREQUENCY MODULATION TECHNIQUE 9

Basic Principles - Frequency Modulation - Phase Modulation - Modulation Index - Sidebands – Noise Suppression – FM Versus AM - Frequency Modulators - Phase Modulators - Frequency Demodulators - Signal reproduction – Receivers - Transceivers.

MODULE III DIGITAL MODULATION TECHNIQUES 9

Introduction – Types of modulation - ASK – FSK – PSK - QAM - Bandwidth Efficiency - Carrier Recovery - Clock Recovery - DPSK - Trellis Code Modulation - Error -Probability -Bit Error Rate - Performance.

MODULE IV SPREAD SPECTRUM TECHNIQUES 9

Introduction, Pseudo noise, properties, model-spread spectrum- performance of DSSS, FHSS - frequency hopping- access techniques–Comparison, Coding of speech for wireless.

MODULE V SATELLITE COMMUNICATION 9

Satellite systems - Satellite Orbits – Spectrum usage – Satellite sub systems - Communication sub system – Power–Antenna – Receiver– Transmitter – Ground station - Satellite application – Global navigation.

L – 45; TOTAL HOURS - 45

TEXT BOOKS:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th edition Pearson Education, 2014.

REFERENCES:

1. Simon Haykin and Michael Moher “Communication Systems”, 5th Edition, John Wiley & Sons, 2010.
2. George Kennedy and Bernard Davis, “Electronic Communication Systems”, 4th Edition, McGraw-Hill Education, 2009.
3. Louis E. Frenzel Jr., “Principles of Electronic Communication Systems”, 4th Edition McGraw-Hill Education, 2016.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Analyze the basic concepts of Frequency Modulation and Phase Modulation.

CO2: Discuss the various Digital modulation techniques.

CO3: Apply suitable modulation schemes and coding for various applications.

CO4: Analyze the various spread spectrum transmission techniques.

CO5: Identify and describe different satellite communication techniques.

Board of Studies (BoS) :

15thBoS of IT held on 16.12.2021

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			L										L	
CO3				H				M			M			
CO4														L
CO5			M				L							

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

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

Statement: Electronics communication system plays vital role in the current world. The study of communication system is to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SEMESTER V

ITDX27	**TCP/IP PROTOCOL SUITE**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To introduce the fundamentals of computer networks, including the OSI model, TCP/IP layers, addressing types, switching techniques, and the basics of the NS2 simulator.

COB2: To explore network layer protocols, along with subnetting and supernetting concepts.

COB3: To explain the key protocols of the transport layer.

COB4: To provide an understanding of the client-server model and application layer protocols such as BOOTP, DHCP, DNS, and TELNET.

COB5: To introduce additional application layer protocols, including FTP, SMTP, SNMP, and HTTP.

MODULE I INTRODUCTION 8

Standards – Internet – History- OSI model – TCP/IP Protocol suite – Addressing –Switching – Connecting devices – IP addressing - Introduction to NS simulator.

MODULE II NETWORK LAYER PROTOCOLS 10

Subnetting– Supernetting– IP packets – Delivery – Routing – Routing module – Routing table – Datagram – Fragmentation – Checksum – IP Design – ARP –RARP - Internet control message protocol – Multicasting -Internet group management protocol

MODULE III TRANSPORT LAYER PROTOCOLS 9

User Datagram protocol – UDP operation – Use – UDP design – TCP services – Flow control – Error control – TCP operation and design – Connection –Congestion control.

MODULE IV APPLICATION LAYER AND CLIENT SERVER MODEL 9

Concurrency – BOOTP – DHCP – Domain name system – Name space – Distribution – Resolution – Messages – Telnet – Rlogin – Network Virtual Terminal – Character Set – Controlling the server – Remote login.

MODULE V APPLICATION PROTOCOLS 9

File Transfer Protocol – Connections – Communication – Simple Mail Transfer Protocol – Simple Network Management Protocol – Hyper Text Transfer Protocol – Transaction – Request and Response messages

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Tata McGraw Hill fourth Edition, 2017.

REFERENCES:

1. Douglas E. Comer, David L. Stevens, “Internetworking with TCP/IP –Volume I, II and III”, Prentice - Hall of India Pvt. Ltd., 6th Edition 2015.
2. Mahbub Hassan and Raj Jain, “High Performance TCP/IP Networking Concepts, Issues and Solutions”, Prentice - Hall of India Pvt. Ltd, 2015

COURSE OUTCOMES:

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

CO1: Explain the history, significance, and purpose of TCP/IP, along with the fundamentals of computer networks and their layers, and design network topologies using the NS2 simulator.

CO2: Design and implement networks using subnetting and supernetting concepts, and describe the operation of IP, ARP, RARP, ICMP, and IGMP protocols.

CO3: Analyze the functionality and mechanisms of transport layer protocols, including TCP and UDP.

CO4: Illustrate the client-server model and describe application layer protocols such as BOOTP, DHCP, DNS, and TELNET.

CO5: Demonstrate an understanding of application layer protocols, including FTP, SMTP, SNMP, and HTTP.

Board of Studies (BoS) : 16thBoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	M	H		H					M			H	M
CO2	L	M	H							M			H	M
CO3		L								M				L
CO4		L								M				L
CO5		L								M				L
CO6	L	M	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.

Statement : The proper learning of the TCP/IP Protocol Suite course can lead to inclusive and sustainable economic growth, full and productive employment for the students.

SEMESTER VI

ITDX28	WIRELESS NETWORK	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the fundamental concepts of wireless communication, mobile networks, and the evolution of WLAN.

COB2: To understand wireless network topologies, cellular concepts, and their operational characteristics.

COB3: To explore the fundamentals of 2G, 3G, and the evolution of 4G networks, along with their architecture and applications.

COB4: To gain knowledge of WPAN and geo-location systems.

COB5: To develop a deep understanding of security challenges in wireless networks.

MODULE I WIRELESS LAN TECHNOLOGIES 9

Introduction -Wireless Networks-Infrastructure and Ad hoc Networks, WLAN Technologies: IEEE 802.11 -System and Protocol Architecture, Physical layer, MAC layer – Hiper LAN-Hiper LAN 2-. WPAN-IEEE 802.15.4, Zigbee, .Blue Tooth ,Home RF ,Wireless USB.

MODULE II PRINCIPLES OF WIRELESS NETWORK OPERATION 9

Wireless networks topologies, cellular topology, cell fundamentals signal to interference ratio calculation, capacity expansion techniques, cell splitting, use of directional antennas for cell sectoring, micro cell method, overload cells, channels location techniques and capacity expansion FCA, channel borrowing techniques, DCA, mobility management, radio resources and power management securities in wireless networks.

MODULE III MOBILE NETWORK LAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol – Dynamic Host Configuration protocol,mobile ad-hoc network: Routing: Destination Sequence distance vector, Dynamic Source Routing Protocol, Alternative protocols and Over view of routing protocols.

MODULE IV CELLULAR STANDARDS 9

Introduction to 2G and 3G standards – GSM- IMT 2000- Fourth Generation (4G) Systems and Beyond - Design Goals for 4G and Related Research Issues - 4G Services and Applications Challenges: Predicting the Future of Wireless Systems

MODULE V SECURITY ISSUES IN WIRELESS SYSTEMS 9

The Need for Wireless Network Security - Attacks on Wireless Networks - Security Services -Wired Equivalent Privacy (WEP) Protocol -Mobile IP - Weaknesses in the WEP Scheme -Virtual Private Network (VPN) ,Point-to-Point Tunneling Protocol (PPTP) ,Layer-2 Transport Protocol (L2TP) , Internet Protocol Security (IPSec)

L –45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", 2nd Edition,PearsonEducation,2012.
2. P. Nicopolitidis, M.S. Obaidat, G.I. papadimitria, A.S. Pomportsis,"Wireless Networks", John Wiley & Sons,2003.

REFERENCES:

1. KavehPahlavan,PrashantKrishnamoorthy,"PrinciplesofWirelessNetworksAunitedapproach",PearsonEducation,2008.
2. M.Mallick,"MobileandWirelessdesignessentials",WileyPublishingInc.2003.

COURSE OUTCOMES:

CO1: Explain the various wireless transmission techniques.

CO2:Discuss the principle of operation of wireless networks and its issues

CO3: Analyze the operation of Mobile IP networks and ability to select the suitable adhoc routing protocols depending on the requirements.

CO4: Conversant with the cellular standards and its architecture

CO5: Identify the various security issues in wireless networks.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

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

Statement: Wireless Information Networking deals with the methodologies and techniques involved in the wireless transmission of information. Since the world is depending more on wireless systems, the demand and need for wireless systems are increasing day by day.

ITDX 29	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL IOT	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To introduce students to the foundational concepts of Industry 4.0.

COB2: To provide insights into AI, AR & VR, cybersecurity, and big data analytics within the context of Industry 4.0.

COB3: To introduce the basics of IIoT and guide students in developing business models for IIoT.

COB4: To explore the role of big data analytics in IIoT, along with concepts of SDN and fog computing.

COB5: To expose students to various applications of IIoT across industries.

MODULE I INTRODUCTION TO INDUSTRY 4.0 9

Introduction: Sensing & actuation, Communication, Networking - Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

MODULE II CYBER SECURITY 9

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analytics – Cyber security in Industry 4.0

MODULE III BASICS OF INDUSTRIAL IoT 9

Basics of Industrial IoT: IIoT-Introduction, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems, IIoT-Business Models, IIoT Reference Architecture - Industrial IoT- Layers: IIoT Sensing.

MODULE IV IIoT ANALYTICS 9

IIoT Analytics - Introduction, Machine Learning and Data Science, R and Julia Programming, Data Management with Hadoop - Software Defined Networks - Security and Fog Computing .

MODULE V APPLICATIONS OF IIoT 9

Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry , Healthcare, Power Plants, Inventory Management & Quality

Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management - Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Case studies.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS :

1. Gilchrist & Alasdair, “Industry 4.0: The Industrial Internet of Things”, Apress, 2017
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, “Industrial Internet of Things: Cyber manufacturing Systems”, Springer, 2017.

COURSE OUTCOMES:

CO1: Explain the basic concepts of Industry 4.0.

CO2: Describe AI, AR & VR, Cyber security and Big data & Analytics in the context of Industry 4.0.

CO3: Discuss basics of IIoT and develop business models in IIoT.

CO4: Explain big data analytics in the context of IIoT and also discuss Software Defined Networks and Fog computing

CO5: Illustrate the applications of IIoT

CO – PO& PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	2					2			3	2
CO2	3	2	2	2	2					2	1	1	2	3
CO3	3	3	2	1	1					2	1		2	1
CO4	3	1	1	1	1					2			3	2
CO5	2	2	1	1	1					2			2	3

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

Statement: The proper learning of Industry 4.0 and Industrial IoT course can lead to inclusive and sustainable economic growth, full and productive employment for the students.

SEMESTER VII

ITDX 30	ADHOC AND SENSOR NETWORKS	L	T	P	C
SDG: 08		3	0	0	3

OBJECTIVES:

COB1: To understand the distinctions between wired and ad hoc networks.

COB2: To acquire knowledge of the various applications of ad hoc networks.

COB3: To explore the characteristics and functioning of proactive and reactive routing protocols.

COB4: To comprehend the behavior and performance of reactive protocols in low mobility environments.

COB5: To analyze the performance of reactive protocols in high mobility environments.

COB6: To recognize the significance and applications of wireless sensor networks.

MODULE I INTRODUCTION 8

Model of Operation - Symmetric Links - Layer-2 Ad Hoc Solutions –Proactive versus Reactive Protocols – Multicast - Commercial Applications of AdHoc Networking – Conferencing –Home Networking –Emergency Services –Personal Area Networks and Bluetooth –Embedded Computing Applications – Technical and Market Factors Affecting AdHocNetworks –Scalability –Power Budget versus Latency –Protocol Deployment and Incompatible Standards.

MODULE II CHANNEL ALLOCATION 10

Channel allocation methods –802.11 WLAN – Classification of MAC protocols - MACA – MACAW – MACABI – CSMA – TSMA

MODULE III DSDV AND DSR PROTOCOLS 10

Introduction-Overview of Routing Methods - Link-State - Distance-Vector - Destination-Sequenced Distance Vector Protocol - Protocol Overview - Route Advertisements - Route Table Entry Structure -Responding to Topology Changes - Route Selection Criteria –DSR Protocol Description – Overview and Important Properties -DSR Route Discovery - DSR Route Maintenance – Additional Route Discovery Features – Additional Route Maintenance Features

MODULE IV AODV PROTOCOL 8

AODV Properties – Unicast Route Establishment – Route Discovery – Expanding Ring Search - Forward Path Setup - Route Maintenance – Local Connectivity Management – Multicast Route Establishment – Route Discovery – Forward Path Setup – Multicast Route Activation/Deactivation – Multicast Tree Maintenance

MODULE V WIRELESS SENSOR NETWORKS 9

Introduction – Sensor Network Architecture – Data Dissemination – Data Gathering – MAC Protocols for Sensor Networks – Location Discovery –Quality of Sensor Networks – Issues in Sensor Networks.

Total Hours : 45

TEXTBOOKS:

1. Charles E. Perkins, “Ad-Hoc Networking”, Addison Wesley, December 2000.
2. C. Siva Ram Murthy, B.S. Manoj, “Adhoc Wireless Networks”, PrenticeHall,2004.
3.

REFERENCES:

1. C.K.Toh, “Adhoc Mobile Wireless Networks: Protocols and Systems”, Pearson Education, 2009.
2. Elizabeth M. Royer and C.K.Toh, “A Review of Current Routing Protocols for Mobile Adhoc Networks”, IEEE Personal Communications,April1999.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1: Demonstrate a clear understanding of the fundamentals of ad hoc networks.

CO2: Identify and apply various channel allocation algorithms utilized in the MAC layer.

CO3: Analyze and explain the operation of DSDV, DSR, and AODV protocols.

CO4: Evaluate and compare the performance of DSDV, DSR, and AODV protocols.

CO5: Distinguish between different routing protocols and address practical challenges in ad hoc networks.

CO6: Illustrate the functionality and applications of wireless sensor networks.

Board of Studies (BoS) :
Mention details of BoS
Ex: 16th BoS of IT held on 18.08.2022

Academic Council:
Mention Number and date
Ex: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L										L	M
CO2	M	M	L										L	M
CO3	M	M	L										L	M
CO4	M	M	L										L	M
CO5	M	M	L										L	M
CO6	M	M	L										L	M

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: The knowledge of the Adhoc and Sensor Networks leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 31	Python for IOT	L	T	P	C
SDG: 8		2	0	2	3

OBJECTIVES:

COB1: Explore the python programming constructs for Raspberry Pi in IOT.

COB2: Understand the interfacing the devices to Raspberry Pi circuit, real time measurements and sensing using IOT.

COB3: Explore advanced data handling and machine learning models in IOT.

MODULE I PROGRAMMING WITH PYTHON AND THE RASPBERRY PI **10**

Python Functions and Modules-File Handling-Libraries and Frameworks for IOT- Raspberry Pi –Architecture and applications. Working with Sensors and Actuators.

MODULE II PRACTICAL INTERFACING IN IOT FOR SMART APPLICATIONS **10**

IOT communication protocols-CoAP, MQTT and WebSocket-Data Collection and storage. Basic IOT Projects-Home Automation. Deployment and scalability.

MODULE III ADVANCED PYTHON FOR IOT **10**

Security in IOT-concepts and Best Practices, Machine learning models for IOT-Tesorflow-Lite Data Handling with SQL, NoSQL (Firebase database in Python) and cloud storage.

PRACTICALS:

List of Experiments:

1. Python programming on
    a. Basic
    b. NumPy
    c. Matplotlib
    d. Decorators
2. Study of Raspberry pi -versions, GPIO pins and details.
3. Interface LED with Raspberry pi
4. Interface SWITCH with Raspberry Pi
5. Interfacing DHT11 with Raspberry Pi.
6. Interfacing PIR Motion sensor to Raspberry Pi
7. IOT controlled LED using Blynk app and raspberry pi

8. IOT based motion detection using IFTTT and raspberry pi
9. controlling-stepper-motors-using-python-with-a-raspberry-pi
10. Machine Learning on a Raspberry Pi: The Complete Guide to Setting Up Your Raspberry Pi

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOK:

1. Gary Smart, “Practical Python Programming for IoT (Build advanced IoT projects using a Raspberry Pi 4, MQTT, RESTful APIs, WebSockets and Python 3”, Packt Publishers, First Edition, Nov 2020.
2. Andy King, “Programming the Internet of Things-An Introduction to building Integrated, Device-to-cloud IOT solutions”,O'Reilly Media, Inc, June 2021.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: Develop a solid understanding of Raspberry Pi and its applications.

CO2: Interface various devices with Raspberry Pi for IoT projects.

CO3: Apply IoT sensors in real-world applications and scenarios.

CO4: Integrate machine learning algorithms into IoT solutions effectively.

CO5: Deploy and manage scalable, secure IoT systems.

Board of Studies (BoS) :	**Academic Council:**
Mention details of BoS	Mention Number and date
Ex: 17thBoS of IT held on	Ex: 15th AC held on 14.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
CO1	H		H			H						M		M
CO2		H		L			H							H
CO3			H					M		L				
CO4	M				M							L	M	
CO5		L		M				M				M		M

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

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

Statement: It enable better management of infrastructure roll-out and maintenance, increase agricultural productivity, and provide additional business opportunities and market intelligence through online services.

ITDX 32	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
SDG: 8 & 4		3	0	0	3

COURSE OBJECTIVES:

The students will:

COB1:understand the basics of programming for heterogeneous architectures.

COB2: know programming for massively parallel processors.

COB3: understand the issues in mapping algorithms for GPUs.

COB4: study the different GPU programming models.

COB5: understand the need for Synchronization and perform synchronization for parallel programming.

MODULE I GPU ARCHITECTURE 9

Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

MODULE II GPU PROGRAMMING 9

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions, Selftuning Applications.

MODULE III PROGRAMMING ISSUES 9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

MODULE IV ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster - CUDA Dynamic Parallelism.

MODULE V OTHER GPU PROGRAMMING MODELS AND APPLICATIONS ON GPUs 9

Introducing OpenCL, OpenACC, Thrust- Designing Scientific Applications on GPUs.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Shane Cook, CUDA Programming: "A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012.

2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors - A Hands-on Approach", Second Edition, Morgan Kaufmann, 2012.
3. GerassimosBarlas, "Multicore and GPU Programming: An Integrated Approach", Paperback ISBN: 9780124171374, elsevier.com, 2015

REFERENCES:

1. Nicholas Wilt, "UDA Handbook: A Comprehensive Guide to GPU Programming", Addison - Wesley, 2013.
2. Jason Sanders, Edward Kandrot, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison - Wesley,2010.
4. Raphael Couturier, "Designing Scientific Applications on GPUs", CRC Press, 21-Nov-2013
3. http://www.nvidia.com/object/cuda_home_new.html

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Describe GPU Architecture.

CO2: Write programs using CUDA.

CO3: Implement algorithms in GPUs to get maximum occupancy and throughput.

CO4: Program in any heterogeneous programming model.

CO5: Perform synchronization for parallel processing.

CO6: Design scientific applications on GPUs.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1					L						L		M	
CO2			M											M
CO3		H						M						H
CO4														M
CO5			M							H			M	
CO6			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 proper learning of GPU Architecture leads to inclusive and sustainable economic growth, full and productive employment for the students.

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

ITDX 33	SOFTWARE DEFINED NETWORKS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn the fundamentals of software defined networks.

COB2:To understand the separation of the data plane and the control plane.

COB3: To study about the SDN Programming.

COB4: To study about the various applications of SDN

MODULE I INTRODUCTION 9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes.

MODULE II OPEN FLOW & SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

MODULE III DATA CENTERS 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

MODULE IV SDN PROGRAMMING 9

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

MODULE V SDN FRAMEWORK 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

L –45 ; TOTAL HOURS – 45

TEXT BOOKS:

1.Paul Goransson and Chuck Black, —Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, —SDN: Software Defined Networks, O'Reilly Media, 2013.

REFERENCES:

1.Siamak Azodolmolky, —Software Defined Networking with Open Flow, Packet Publishing, 2013.

2. Vivek Tiwari, —SDN and Open Flow for Beginnersǁ, Amazon Digital Services, Inc., 2013.

3. Fei Hu, Editor, —Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

COURSE OUTCOMES:

CO1: Analyze the evolution of software defined networks

CO2: Express the various components of SDN and their uses

CO3: Explain the use of SDN in the current networking scenario

CO4: Design and develop various applications of SDN

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO 1	PSO 2	PSO 3
CO1		M			L						M			L	
CO2				L											
CO3		H						M						L	L
CO4	M					M									
CO5			M					M		H				L	

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

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

The problem solving methodologies of SDN allows organizations to use software and hardware from multiple vendors to have customized network services and infrastructure.

SPECIALIZATION III
DATA SCIENCE & AI

SEMESTER V

ITDX 41	**BUSINESS AND DATA ANALYTICS**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To introduce the business analytics and data mining concepts.

COB2: To impart the data visualization and dimension reduction techniques.

COB3: To discuss the performance of prediction / classification methods.

COB4: To explain advanced analytic techniques.

COB5: To introduce various model evaluation techniques.

MODULE I INTRODUCTION 8

Introduction to Business Analytics, data mining, Big Data and data science, steps in data mining, preliminary steps - Business Analytics Process, CRISP-DM, overfitting and underfitting

MODULE II DATA EXPLORATION AND DIMENSION REDUCTION 10

Uses of data visualization, basic charts, multidimensional visualization, curse of dimensionality, practical considerations, correlation analysis, principal component analysis, dimension reduction using regression models, classification and regression trees.

MODULE III PERFORMANCE EVALUATION 9

Evaluating Predictive performance, judging classifier performance, judging ranking performance, and oversampling

MODULE IV ADVANCED ANALYTICS 9

Multiple linear regression, k-nearest neighbors, classification and regression trees, logistic regression, neural nets, discriminative analysis

MODULE V MODEL EVALUATION TECHNIQUES 9

Model Evaluation Techniques for the Description Task, Model Evaluation Techniques for the Estimation and Prediction Tasks, Model Evaluation Techniques for the Classification Task, Error Rate, False Positives, and False

Negatives, Misclassification Cost Adjustment to Reflect Real-World Concerns ,Decision Cost/Benefit Analysis, Lift Charts and Gains Charts, Interweaving Model Evaluation with Model Building , Confluence of Results: Applying a Suite of Models.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. GalitShmueli ,Peter C. Bruce,Mia L. Stepiiens, Nitin R. Patel, “Data Mining For Business Analytics Concepts, Techniques, and Applications in R”, John Wiley & Sons, 2018.
2. Daniel T. Larose & Chantal D. Larose, “Discovering Knowledge in Data: An Introduction to Data Mining”, John Wiley & Sons, Second Edition, 2014.

REFERENCES:

1. Ron Klimberg and B. D. McCullough, “Fundamentals of Predictive Analytics with JMP”, SAS Institute.
2. Marc J. Schniederjans, Dara G. Schniederjans , Christopher M. Starkey, “Business analytics principles, concepts and applications what, why and how”, Pearson.
3. Saxena, Rahul, Srinivasan, Anand, “Business Analytics A Practitioner’s Guide”, Springer.
4. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
5. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1: Explain the business analytics and data mining concepts.

CO2: Apply data visualization and dimension reduction techniques.

CO3: Evaluate the performance of prediction / classification methods.

CO4: Apply the knowledge of advanced analytic techniques.

CO5:Discuss various model evaluation techniques.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PS O2
CO1	3	1	1	1	1					2		1	1	1
CO2	3	2	1	1	1					1		1	1	3
CO3	3	1	1	1	1					1		1	1	3
CO4	3	2	1	1	1					1		1	1	3
CO5	3	1	1	1	1					2		1	1	1

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

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

Statement : The proper learning of the Business and Data Analytics course can lead to inclusive and sustainable economic growth, full and productive employment for the students.

SEMESTER VI

ITDX 42	**PROGRAMMING IN R**	**L**	**T**	**P**	**C**
SDG: 8		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

COB1: To introduce the basic concept of R programming.

COB2: To provide knowledge in data analysis and time series analysis

COB3: To provide hands on experience in handling data, linear regression, ANOVA and time series analysis.

MODULE I INTRODUCTION TO R PROGRAMMING 10

Introduction – R Programming Structures – Variables Basics - Navigating the Software - Input and Output - Data Structures.

MODULE II DATA ANALYSIS 10

Data Transformations - Strings and Dates – Probability - General Statistics.

MODULE III GRAPHICS 10

Graphics - Linear Regression and ANOVA - Useful Tricks - Beyond Basic Numerics and Statistics - Time Series Analysis - Simple Programming.

PRACTICALS

List of Experiments

1. Implementations of data transformation
2. Implementations of strings and dates
3. Implementations of linear regression
4. Implementations of ANOVA analysis
5. Implementations of time series analysis.

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOKS:

1. JD Long, Paul Teetor, "R Cookbook", 2nd Edition, O'Reilly Media, Inc., 2019.

REFERENCES:

1. Colin Gillespie & Robin Lovelace, "Efficient R Programming: A Practical Guide to Smarter Programming", O'Reilly Media, Inc., 2017.
2. Hadley Wickham, "Advanced R", 2nd Edition, CRC Press, 2019.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: explain the structure of R programming and write simple R program.

CO2: write simple R program using strings and dates.

CO3: explain data transformation and general statistical concepts.

CO4: analyze data using various graphs and charts

CO5: demonstrate the linear regression and ANOVA analysis

CO6: apply time series analysis for the given data sets.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	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												M	
CO2	M												M	
CO3			M	M									M	
CO4				M									M	
CO5				M									M	
CO6				M									M	

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

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

Statement: It provides fundamental knowledge on R programming to analyze data with hands on experience, which can add to productive employment.

ITDX 43	ARTIFICIAL INTELLIGENCE	L	T	P	C
SDG:1		3	0	0	3

COURSE OBJECTIVES:

COB1: To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.

COB2: To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.

COB3: To provide the mathematical background for carrying out the optimization associated with neural network learning.

COB4: To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

COB5: To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

MODULE I INTRODUCTION 9

Computerized reasoning - Artificial Intelligence (AI) - characteristics of an AI problem - Problem representation in AI - State space representation - problem reduction.

MODULE II SEARCH PROCESS 9

AI and search process - Brute force search techniques, Depth first, Breadth first search techniques, Hill climbing, Best first search, AND/OR graphs, A* algorithm - Constraint satisfaction.

MODULE III KNOWLEDGE REPRESENTATION 9

Logic, Propositional logic - Tautology - Contradiction - Normal forms - Predicate logic - Rules of inference - Resolution - Unification algorithm - Production rules - Semantic networks - Frames – Scripts - Conceptual dependency.

MODULE IV KNOWLEDGE ENGINEERING 9

Design and architecture of expert systems - Expert system life cycle - Knowledge acquisition – difficulties - strategies - major applications areas - Qualitative study of expert systems, DENDRAL, MYCIN.

MODULE V MACHINE LEARNING 9

Frame work for learning – Inductive learning –Supervised, Unsupervised learning – Parallel distributed processing – Genetic Algorithms .

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Stuart Russel and Peter Norvig, " Artificial Intelligence – a modern approach", Prentice Hall, 2003.

REFERENCES:

1.Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 2003.

2.Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, 2000.

3.Luger George F and Stubblefield William A, "Artificial Intelligence : Structures and Strategies for Complex Problem Solving", Pearson Education, 2002.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

CO5: apply knowledge representation, reasoning, and machine learning techniques to real-world problems.

CO6: Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

Board of Studies (BoS) :
Ex: 8thBoS of CSE held on 25.08.2020

Academic Council:
19th AC held on 29.09.2022

	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
CO 1	H	H	H	M	M	L				L	H	H	H	M
CO 2	L	L	H	M	M	H				M	M	H	M	M
CO 3	H	H	L	L	L	H				M	L	H	L	L
CO 4	M	M	L	M	L	M				M	M	H	M	
CO 5	L	L	H	M	M	H				M	M	H	M	M
CO 6	H	H	L	L						H		L	L	

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

SDG 1 : End poverty in all its forms everywhere.

Statement : AI Sector will produce new employment to peoples, thus providing them with salary and ending poverty.

ITDX 44	DATA MINING TECHNIQUES AND TOOLS	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the concept of data mining with a detailed coverage of basic tasks, metrics and Implementation of Data Warehouse.

COB2: To provide knowledge in association rule mining. To understand the classification algorithms.

COB3: To provide knowledge in cluster analysis and data mining tools.

MODULE I INTRODUCTION 8

Need for Data warehousing and Data Mining - Statistical Description of Data - Measuring Data Similarity and Dissimilarity - Data Warehouse: Basic Concepts - Data Warehouse Implementation - Data Generalization by Attribute-Oriented Induction.

MODULE II DATA PREPARATION AND ASSOCIATION RULE MINING 8

Data Pre-processing: An Overview of Data Cleaning - Data Integration - Data Reduction - Data Transformation (ETL) and Data Discretization - Frequent Itemset Mining Methods - Pattern Evaluation - Pattern Mining in Multilevel, Multidimensional Space - Constraint-Based Frequent Pattern Mining.

MODULE III CLASSIFICATION 7

Introduction - Decision Tree Induction - Rule-Based Classification – Classification by Backpropagation - Support Vector Machines .

MODULE IV CLUSTER ANALYSIS 7

Cluster Analysis: Overview Partitioning Methods Hierarchical Methods Density-Based Methods Grid-Based Methods Evaluation of Clustering Probabilistic Model Based Clustering - Outliers and Outlier Analysis Data Mining Applications - Introduction to WEKA tool Introduction to R.

PRACTICALS

List of Experiments

1. Prepare data warehouse for mobile user.
2. Perform OLAP operations
3. Calculate overall statistics such as distribution of mobile users over gender, age groups, distribution of used smartphone brands, distribution

of app-category-usage

4. Preprocess data and extract meaningful features
5. Prepare a recommendation system for online shopping
6. Clustering of music files and automatic playlist generation

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOKS:

1. Jiawei Han and MichelineKamber," Data Mining Concepts and Techniques", Third Edition, Elsvier Inc., 2012.
2. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press, 2019

REFERENCES:

1. Robert Nisbet, Ph.D., Gary Miner, Ph.D. and Ken Yale, D.D.S., J.D., "Handbook of Statistical Analysis and Data Mining Applications", Academic Press, 2018
2. G.K Gupta, "Introduction to Data Mining with Case Studies", Third Edition, PHI Learning Private Limited, 2014.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Explain the concept of data warehousing

CO2: Preprocess the data

CO3: Discuss the association rule mining

CO4: Cluster and classify the given data

CO5: Demonstrate the data mining tool

CO6: Apply suitable data mining algorithm for real-time applications

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	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												M	
CO2	M												M	
CO3			M	M									M	
CO4				M									M	
CO5				M									M	
CO6				M									M	

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

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

Statement: It provides deep knowledge on data mining techniques with hands on experience, which can add to productive employment.

ITDX 45	BIG DATA ANALYTICS	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To Understand big data analytics.

COB2: To Discuss data analytic methods.

COB3: To learn technology and tools for analytics.

MODULE I INTRODUCTION TO BIG DATA ANALYTICS 9

Big Data Overview–State of the Practice in Analytics–Data Analytics Life cycle Overview– data analytics life cycle-discovery–Data preparation–Model planning– Model building–Communicate results–Operationalize.

MODULE II DATA ANALYTIC METHOD 9

Introduction to R - Exploratory data analysis–Statistical methods for evaluation–Clustering–k-means–Association rules.

MODULE III ADVANCED ANALYTICS 9

Regression–linear regression–Logistic regression–Classification–Data Visualization - Decision trees – Regression - Navies Bayes - Diagnostics of classifiers.

MODULE IV TIME SERIES AND TEXT ANALYSIS 9

Overview of Time Series Analysis - ARIMA Model- Text Analysis - Text Analysis Steps - A Text Analysis Example- Collecting Raw Text - Representing Text – Term Frequency—Inverse Document Frequency - Categorizing Documents by Topics – Determining Sentiments.

MODULE V TECHNOLOGYAND TOOLS 9

Analytics of unstructured data-The Hadoop Ecosystem–No SQL-SQL Essentials-Database Text Analysis-Advanced SQL–MADlib.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", &Sons, Inc., Indiana polis, Indiana, 2015.
2. RajatMehta,"BigDataAnalyticswith Java",PacketPublishingLtd,2017.

REFERENCES:

1. AnilMaheshwari,“Data Analytics”, McGrawHillEducation,2017.
2. VigneshPrajapati,“Big data analytics withR andHadoop”,Packetpublishing,2013.
3. MichaelMinelli,MicheleChambersandAmigaDhiraj,“Bigdata,BigAnalytics”,JohnWiley&Sons,Inc,2013.
4. MikeBarlow,“Real-timebigdataanalytics-emergingarchitectureby,O’ReillyMedia,FirstEdition,2013.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Discuss the basics of big data analytics.

CO2: Explain the methods of analytics.

CO3: Describe the advanced analytics methods.

CO4: Perform time series and text mining.

CO5: Carry out the analytic projects.

CO6: Setup environment using technology and tools forAnalytics.

Board of Studies (BoS) :
16thBoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	H	H	H		M		H	M	H	H	H	H
CO2	H	H	H	H	H		H		M	M	H	H	H	H
CO3	H	M	H	H	H		H		H	H	H	H	H	H
CO4	H	M	H	H	H		H		H	H	H	H	H	H
CO5	H	H	H	H	M		H		H	H	H	H	H	H
CO6	H	H	H	H	H		H		H	H	H	H	H	H

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

SDG4:Ensuring inclusive and equitable quality education for all personsand promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all-inclusive and thorough knowledge about Big data analytics.

ITDX 47	ANALYTICS OF THINGS (AOT)	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To understandthe needs of AoT in Real Time.

COB2: To explore knowledge about the IoT design methodology.

COB3: To study the Raspberry Pi and device integration.

COB4: To explorethe knowledge about the real-time data analysis using various models.

COB5: To understandthe IoT Tools and some real-time case studies.

MODULE I INTRODUCTION TO IOT AND AOT 9

Introduction to Analytic of Things- Why do we need AoT-Challenges faced by AOT- Introduction to IOT-Physical design of IOT- Logical design of IOT-IOT enabling Technologies-IOT Levels-Domain specific IOT- IOT and M2M-Difference between IOT and M2M-Software defined networking-

MODULE II DEVELOPING OF INTERNET OF THINGS 9

IoT design methodology-purpose requirement specification-Process specification-Domain model specification- Information model specification-Service specification-IoT level specification-Function view specification-Operational view specification-Device and component integration-application development- Case study on IOT system for weather monitoring.

MODULE III LOGICAL DESIGN USING PYTHON 9

Introduction to Python-Python Data types and structures-Functions-Modules-Packages-File Handling-Date/Time Operations- Classes- Python packages for IoT- IoT physical design- Raspberry Pi- Raspberry Pi board-Raspberry Pi interfaces- Programming Raspberry Pi with Python: Controlling LED with Raspberry Pi-Interfacing a LED with Raspberry Pi-Interfacing a Light Sensor with Raspberry Pi-Other IOT devices.

MODULE IV ANALYTICS OF THINGS 9

Data Analytics for IoT-Apache Hadoop: MapReduce Programming Model-Hadoop Map Reduce Job Execution- Map Reduce Job Execution workflow- Hadoop cluster setup-Apache oozie: setting up Oozie- Oozie workflow for IoT data analysis - Apache Spark-Apache storm: Setting up a storm cluster- Using Apache storm for Real time Data Analysis-REST based approach.

MODULE V TOOLS FOR IOT AND CASE STUDIES 9

Introduction-Chef-Setting up Chef- Chef case studies-Puppet-Puppet case study-IoT code generator- Case studies for IOT design: Introduction-Home automation- Smart cities- Environment based IoT automations- Agriculture-Productive Applications.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Orient Blackswan Private Limited - New Delhi, 2015, 1st Edition. (ISBN: 978-8173719547).
2. ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Orient Blackswan Private Limited - New Delhi, 2015, 1st Edition. (ISBN: 978-8173719547).

REFERENCES:

1. Analytics of Things- https://analyticsindiamag.com/analytics-things-aot/.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Explore the IoT and AoT.

CO2: Explain design methodology involved in IoT.

CO3: familiar with Raspberry Pi.

CO4: Explore the methods involved in handling data collected by IoT devices.

CO5: Explore the IoT tools and real-time applications of IoT and AoT.

Board of Studies (BoS) : 16thBoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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

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

Statement: Analytics of Things describe the analysis of the data generated by the Internet of Things devices. This leads to make the connected devices smart and to give the devices the ability to make intelligent decisions.

ITDX 48	**ARTIFICIAL INTELLIGENCE FOR DATA SCIENCE**	**L**	**T**	**P**	**C**
SDG: 8		**2**	**0**	**2**	**3**

COURSE OBJECTIVES:

COB1: To understand the evolution and significance of Artificial Intelligence.

COB2: To identify and explore tools and methods to implement Data Science.

COB3: To explore the concepts of machine learning and deep learning.

COB4: To explore the frameworks of AI for data science

MODULE I INTRODUCTION to ARTIFICIAL INTELLIGENCE (AI) 8

Introduction to AI – introduction to data science- scope of AI & Data science- AI facilitates data science – Techniques and Methodologies for using AI in data science.

MODULE II DEEP LEARNING (DL) FRAMEWORKS 7

Deep Learning Systems – Working of deep learning systems – Deep learning framework- Main deep learning programming languages- Deep learning methodologies and applications.

MODULE III BUILDING DL USING MXNEXT, TENSOR FLOW & KERAS 8

Tensor Flow architecture – Core Components – Tensor flow in action – Visualization in tensor flow – High level APIs in tensor flow- Mxnet in action-core components-Keras in action – Converting Keras models to tensor flow estimators.

MODULE IV BUILDING OPTIMIZER BASED ON GENETIC ALGORITHMS AND PARTICLE SWARM OPTIMIZATION 7

Standard Genetic Algorithms (GA) – Implementation of GA's in Julia – Main variants of GA's- GA frameworks. Standard Particle Swarm Optimization (PSO) algorithm's – Implementation of PSO – PSO frameworks – Variants in PSO.

PRACTICALS

List of Experiment

1. Implement the particle swarm optimization using Julia programming.
2. Implement the classification model by using convolution neural network and deep neural networks using Python.
3. Implement the Long Short Term Memory (LSTM) time series prediction model using Python.
4. Implement the Gated Recurrent Unit (GRU) time series prediction model using Python.
5. Implement Auto Encoder using Python.
6. Implement the classification model using ResNet Model (pre trained deep neural network).
7. Implement the classification model using VGG Model (pre trained deep neural network).
8. Implement the classification model using Inceptionv3 Model (pre trained deep neural network).

L – 30 ; P – 30; TOTAL HOURS –60

TEXT BOOKS:

1. YunusEmrahBulut, Zacharias Voulgaris, “AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond”,Technics Publications, 2018, ISBN: 9781634624114.

REFERENCES:

1. ShaiShalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.
2. Kevin Knight and Elaine Rich, “Artificial Intelligence”, Third Edition, July 2017.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1: understand the evolution and significance of Artificial Intelligence

CO2: identify and explore tools and methods to implement Data Science.

CO3: explore the concepts of machine learning and deep learning.

CO4: explore the frameworks of AI for data science

CO5: understand the problems and solve the case studies using AI.

CO – PO& PSO MAPPING

	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	1							3		3	2	2
CO2	3	1	2							2		3	3	1
CO3	1	2	3				1			3		3	3	1
CO4	1	2	2				1			2		2	3	1
CO5	2	2	2							3		3	2	2
CO6	2	1	1							2		1	2	1

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1: Explore fundamentals of Artificial intelligence and data science.

CO2:explainthe concepts of Deep learning and tools.

CO3:build Deep learning frameworks using tensor flow, MX net and Keras.

CO4:build DL frameworks using genetic algorithm and PSO.

CO5: Have hands on experience on various popular programming languages of DL.

CO6: Explore advanced frameworks of AI for data science.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

Statement : Despite legitimate concerns about automation replacing jobs, AI augmentation and targeted automation with intelligent devices can improve the work environment, increase productivity, and be a significant driver of economic growth

ITDX 49	SCALABLE DATA SCIENCE	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To apply quantitative modeling and data analysis techniques to the solution of real-world business problems, communicate findings, and effectively present results using data Visualization techniques.
COB2: To recognize and analyze ethical issues in business related to Intellectual property, data security, integrity, and privacy.

COB3: To apply ethical practices in everyday business activities and make well-reasoned ethical business and data management Decisions.
COB4: To demonstrate knowledge of statistical data analysis techniques Utilized in business decision making.
COB5: To use data mining software to solve real-world problems.

MODULE I INTRODUCTION 9

Probability: Concentration inequalities -Linear algebra: PCA, SVD |Optimization: Basics, Convex GD - Machine Learning: Supervised, Generalization, Feature learning, Clustering.

MODULE II MEMORY EFFICIENT DATA STRUCTURES 9

Hash functions, Universal -Perfect hash families -Bloom filters - Sketches for distinct count – Misra-Gries sketch -Statistical Mechanics an overview.

MODULE III NEIGHBORS SEARCH 9

Multi-probe, B-bit hashing, Data dependent variants.

MODULE IV RANDOMIZED NUMERICAL LINEAR ALGEBRA 9

CUR Decomposition - Sparse RP, Subspace RP, Kitchen Sink.

MODULE V MAP REDUCE AND RELATED PARADIGMS 9

Map reduce - Programming examples - (page rank, k-means, matrix multiplication) -Big data: computation - Hadoop ecosystem.

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Leskovec, A. Rajaraman and JD Ullman. Mining of Massive Datasets. Cambridge University Press, 2nd Ed.
2. Muthu Krishnan, S. (2005). Data streams: Algorithms and applications. Foundations and Trends® in Theoretical Computer Science, 1(2), 117-236.
3. Woodruff, David P. ""Sketching as a tool for numerical linear algebra."" Foundations and Trends® in Theoretical Computer Science 10.1–2 (2014): 1-157.
4. Mahoney, Michael W. ""Randomized algorithms for matrices and data."" Foundations and Trends® in Machine Learning 3.2 (2011): 123-224.

COURSE OUTCOMES:

On successful completion of the course, the students will be able to

CO1:use/applymap-reduce algorithms for processing big- data, including its robust clean-up via regular expressions.

CO2: extract, transform and load data into distributed file systems such as Hadoop.

CO3: explain the working with structured data using data frames and dynamic querying in sparkSQLoncatalyst.

CO4: develop the basic applications of some of the standard learning algorithms in Spark's machine learning and Distributed graph processing libraries.

CO5: Understand about data types as -structured text data (logs generated by machines, tabular data from various open data sources), geospatial data (and their integration with other typesof data).

CO6: Apply modern data science methods to one or more domains of application (e.g. business analytics, finance, biotechnology, and public health).

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	H	H		H		M	M	M	M	H	H
CO2	H	M	H	H	M		H		M	M	M	M	H	H
CO3	H	M	H	H	M		H		M	M	M	M	H	H
CO4	H	M	H	H	M		H		M	M	M	M	H	H
CO5	H	H	H	M	L		H		H	M	M	H	M	H
CO6	H	H	H	H	M		H		H	H	H	M	H	H

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

SDG4:Ensuring inclusive and equitable quality education for all personsand promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to provide through knowledge about scalable data science.

ITDX 50	DEEP LEARNING	L	T	P	C
SDG: 8 & 4		2	0	2	3

COURSE OBJECTIVES:

COB1: To learn the machine learning basics.

COB2: To study the various deep neural network models.

COB3: To expose the students to sequence modeling.

COB4: To appraise the recent advances in deep learning like CNN and RNN models.

COB5: To know the various real time applications of deep learning.

MODULE I MACHINE LEARNING ALGORITHMS 9

Machine Learning Basics– Learning Algorithms – Maximum Likelihood Estimation – Bayesian Statistics – Basics of Supervised Learning Algorithms and Unsupervised Learning Algorithms – Building a Machine Learning Algorithm – Challenges Motivating Deep Learning.

MODULE II DEEP NEURAL NETWORK 12

Introduction to Neural Networks – The Biological Neuron – The Perceptron – Multilayer Feed-Forward Networks - Training Neural Networks – Activation Functions – Loss Functions – Hyperparameters- Deep feed forward networks – Architecture design - Gradient based learning – Back propagation and other differentiation algorithms- Regularization of deep learning-Semi-supervised learning – multitask learning.

MODULE III CONVOLUTION NEURAL NETWORKS & RECURRENT NEURAL NETWORKS 9

Unsupervised Pretrained Networks - Deep Belief Networks - Generative Adversarial Networks – Convolutional Neural Networks (CNNs) - CNN Architecture Overview - Applications of CNNs- Sequence modeling: Recurrent Neural Networks (RNN) - General RNN Architecture - Long Short-Term Memory (LSTM) Networks –Gated Recurrent Unit (GRU)-Case study: ResNet

PRACTICALS

LIST OF EXPERIMENTS:

1. Study of Google Colab& Python libraries such as Pandas, Numpy, Matplotlib, &Scikit Learn for ML Applications.
2. Build classification model using SVM algorithm.
3. Build classification model using Naïve Bayes algorithm.

4. Build classification model using Decision Tree algorithm.
5. Performance analysis of Classification Algorithms on a specific dataset.
6. Implement Prediction model using Linear Regression algorithm.
7. Build classification model using CNN algorithm.
8. Build a Time series model using Simple Recurrent neural network model.
9. Build a Time series model using Long Short Term Memory model.
10. Build a Time series model using Gated Recurrent Unit.

L – 30 ; P – 30 ; TOTAL HOURS –60

TEXT BOOKS:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 2016.
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O'Reilly Media, Inc, 2017.

REFERENCES:

1. Raúl Rojas, “Neural Networks: A Systematic Introduction”, Springer Science & Business Media 2013.
2. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, 1stEdition, ISBN: 978- 1259096952, 2013.
3. LaureneFausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Pearson, 1st Edition, ISBN- 978-8131700532, 2004.
4. Li Deng and Dong Yu, “Deep Learning Methods and Applications”, Now Publisher, 1st Edition, ISBN: 1932-8346, 2014.
5. Mark Hodnett (Author), Joshua F. Wiley (Author), Yuxi (Hayden) Liu (Author), Pablo Maldonado (Author), “Deep Learning with R for Beginners: Design neural network models in R 3.5 using TensorFlow, Keras, and MXNet.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Explain the concepts of machine learning.

CO2: Differentiate the various deep neural network models.

CO3: Design systems by applying appropriate deep neural networks concepts.

CO4: Analyse and provide modification to deep learning principles to suit any application.

CO5: Apply deep learning concepts for solving real time problems.
CO6: Evaluate the role of sequence modeling

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	M									L			L	
CO2		M											L	
CO3			H										H	M
CO4		M												M
CO5		L				M								M
CO6		M											L	

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Statement: The skills developed with the deep neural networks like CNN. RNN, LSTM and GRU leads to sustainable economic growth with productive employment and decent work for all.

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

Statement: Students of both male and female are given deep neural network techniques skills needed for implementing real time applications. This will substantially increase the number of students who have relevant technical skills in Google Colab& Python libraries for employment, decent job and entrepreneurship.

ITDX51	COMPUTER VISION AND IMAGE PROCESSING	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To review image processing techniques for computer vision.

COB2: To understand shape and region analysis.

COB3: To understand Hough Transform and its applications to detect lines, circles, ellipses.

COB4: To understand three-dimensional image analysis techniques.

COB5: To understand motion analysis.

COB6: To study some applications of computer vision algorithms.

MODULE I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

MODULE II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

MODULE III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

MODULE IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction

to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

MODULE V APPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

L – 45 ; TOTAL HOURS –45

TEXT BOOKS:

1. E. R. Davies, —Computer & Machine Vision‖, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, —Computer Vision: Algorithms and Applications‖, Springer 2011.

REFERENCES:

1. D. L. Baggio et al., —Mastering OpenCV with Practical Computer Vision Projects‖, Packt Publishing, 2012.
2. Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing images‖, O'Reilly Media, 2012.
3. Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer Vision‖, Third Edition, Academic Press, 2012.
4. Simon J. D. Prince, —Computer Vision: Models, Learning, and Inference‖, Cambridge University Press, 2012.

COURSE OUTCOMES:

Upon completion of this course, the students should be able to

CO1: Implement fundamental image processing techniques required for computer vision.

CO2: Perform shape analysis and Implement boundary tracking techniques

CO3: Apply chain codes, other region descriptors., Hough Transform for line, circle, and ellipse detections.

CO4: Apply 3D vision techniques.

CO5: Implement motion related techniques

CO6: Develop applications using computer vision techniques.

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

16thBoS of IT held on 18.08.2022 19th AC held on 29.09.2022

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	L	L	L											
CO2	L	L	L											
CO3	L	H	L											
CO4	L	H	L											
CO5	L	M	L											
CO6	L	H	L											

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

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Understanding the concept of image processing related to computer vision and its applications and providing solutions to various problems using different computational techniques enable both the genders to get a quality education and promote their lifelong learning opportunities in the fastly growing internet field.

ITDX 52	PREDICTIVE ANALYTICS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

The students will:

COB1:learn how to prepare the data for predictive model development.

COB2:learn how to develop models to predict categorical and continuous outcomes using techniques such as regression algorithms, decision trees, neural networks, support vector machines and Bayesian network models.

COB3:learn the different predictive techniques for model development.

COB4:advice on when and how to use each model.

COB5:learn how to combine two or more models to improve prediction.

MODULE I MACHINE LEARNING ALGORITHMS 9

Introduction to data mining, Reading data from various sources, Data visualization, Distributions and summary statistics, Relationships among variables, Extent of Missing Data. Segmentation, Outlier detection, Automated Data Preparation, Combining data files, Aggregate Data, Duplicate Removal, Sampling DATA, Data Caching, Partitioning data, Missing Values-applications of data mining.

MODULE II MODEL DEVELOPMENT AND TECHNIQUES 9

Data Partitioning, Model selection, Model Development Techniques, Regression techniques, Decision trees, Neural networks, Discriminant analysis, Support vector machine, Bayesian Networks, Linear Regression, Cox Regression, Association rules, Principal Components, Random forests.

MODULE III MODEL ASSESMENT AND SELECTION 9

Model validation-Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate ,Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation ,Boot strap methods, conditional or expected test error, Assessing model performance-updating a model.

MODULE IV ADDITIVE MODELS AND BIG DATA ANALYTICS 8

Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting, Real time examples- Big data analytics, Introduction to

big data, Big data platform – Intelligent data analysis.

MODULE V IMPLEMENTATION OF CLASSIFICATION METHODS AND PERFORMANCE ANALYSIS **10**

Implementation of the following methods using R or MATLAB: Simple and multiple linear regression, Logistic regression, Linear discreminant analysis, Ridge regression, Cross-validation and boot strap, Fitting classification and regression trees, K-nearest neighours, Principal component analysis, K-means clustering, Random forests, Assessing Performance of a classification Algorithm, Study of SPSS modeler.

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.
2. G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer, 2013
3. E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010
4. Eric Siegel, “Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die”, Wiley Publications, 2013.

REFERENCES:

1. C.M.Bishop –Pattern Recognition and Machine Learning,Springer, 2006.
2. L.Wasserman-All of statistics- A Concise Course in Statistical Inference, Springer, 2004.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Understand the process of formulating business objectives, data selection/collection & data preparation

CO2: Discuss the different predictive techniques to successfully design & build a model.

CO3: Compare & evaluate the underlying predictive modeling techniques.

CO4: Select appropriate predictive modeling approaches to identify cases to progress with.

CO5: Implement the predictive models for a various business application.

CO6: Apply predictive modeling approaches using a suitable package such as SPSS Modeler.

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

16thBoS of IT held on 18.08.2022 19th AC held on 29.09.2022

	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			L								L	
CO2		L								L				M
CO3		H			L			M						L
CO4					H									M
CO5					M									M
CO6	H				M									M

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

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

Statement: The skills developed with the predictive model development techniques like Regression techniques, Decision trees, Neural networks, Support vector machine, Bayesian Networks, Association rules, Principal Components and Random forests leads to sustainable economic growth with productive employment and decent work for all.

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

Statement: Students of both male and female are given implementation of classification methods skills needed for developing a good predictive model. This will substantially increase the number of students who have relevant technical skills in R programming, MTLAB and SPSS modeler for employment, decent job and entrepreneurship.

ITDX 53	MATHEMATICAL FOUNDATIONS FOR DATA SCIENCES	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: Understand the basics of data science.

COB2: Understand the fundamental concepts of linear algebra.

COB3: Understand the basic concepts of Probability.

COB4: Understand the Linear regression.

COB5: Understand the approximation algorithms.

MODULE – I Basics of Data science 9

Basics of Data Science: Introduction; Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective; Structured thinking for solving data science problems.

MODULE – II LinearAlebra 9

Linear Algebra: Matrices and their properties (determinants, traces, rank, nullity, etc.); Eigenvalues and eigenvectors; Matrix factorizations; Inner products; Distance measures; Projections; Notion of hyperplanes; half-planes.

MODULE – III Probabilty and Statistics 9

Probability, Statistics and Random Processes: Probability theory and axioms; Random variables; Probability distributions and density functions (univariate and multivariate); Expectations and moments; Covariance and correlation; Statistics and sampling distributions; Hypothesis testing of means, proportions, variances and correlations; Confidence (statistical) intervals; Correlation functions; White-noise process.

MODULE – IV Optimization 9

Optimization: Unconstrained optimization; Necessary and sufficiency conditions for optima; Gradient descent methods; Constrained optimization, KKT conditions; Introduction to non-gradient techniques; Introduction to least squares optimization; Optimization view of machine learning. Introduction to Data Science Methods: Linear regression as an exemplar function approximation problem; Linear classification problems.

MODULE V Approximation algorithms 9

Turing Machines, Recursive and Recursively Enumerable languages. Cantor’s Diagonalization theorem. Complexity classes - NP-Hard and NP-complete Problems - Cook's theorem NP completeness reductions. Approximation algorithms

REFERENCES:

1. G. Strang. Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016.
2. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010.
3. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
4. David G. Luenberger . Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969.
5. Cathy O'Neil and Rachel Schutt . Doing Data Science, O'Reilly Media, 2013.
6. H. Cormen, C. E. Leiserson, R. L. Rivest, C Stein, Introduction to Algorithms, Prentice Hall India, Year.

COURSE OUTCOMES:

Common phrase

CO1: Ability to use the mathematical concepts in the field of data science.

CO2: Employ the techniques and methods related to the area of data science in variety of applications.

CO3: Apply logical thinking to understand and solve the problem in context.

CO4: Apply prediction techniques to solve real world problems.

CO5: Apply Approximation algorithms.

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

16thBoS of IT held on 18.08.2022 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M						M		
CO2	H			L			L		M		M			
CO3		L						H			H			
CO4	H				L								H	
CO5		H							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: This course is an introduction to the mathematical foundations of data science and machine learning. The central theme of the course is

the use of linear algebra and optimization in posing and solving modern problems leveraging data focusing on various applications

ITDX 54	DATA SCIENCE USING PYTHON	L	T	P	C
SDG: 13		2	0	2	3

COURSE OBJECTIVES:

The students have to

COB1: identify data sources and understand the handling of data.

COB2: prepare the cleaned and processed data for model building.

COB3: apply the classification models to solve the complex problem.

COB4: forecast the data using prediction models.

MODULE I INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING 7

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types. Applications of Data science. Phases in data science.

MODULE II DATA EXTRACTION AND MANIPULATION 8

Data- sources of data, data sets, data warehouses, data types. Data collection using web scraping. Data summarization. Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries. Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format – Data Pre-processing - Data Analysis and Visualization.

MODULE III CLASSIFICATION AND CLUSTERING 8

Python packages for data science. Building classification models- support vector model, decision tree, Naïve bayes algorithm, Evaluation metrics of classification models. Clustering Models- Grouping – Cluster Analysis- distance measures, partitioning, hierarchical, density based methods, KNN, Market basket Analysis. Evaluation metrics of clustering models.

MODULE IV FORECASTING MODELS 7

Linear Regression-Time series prediction Model - ARIMA Model- Long Short Term Memory (LSTM)- Recurrent neural network (RNN).

Practical:

List of Experiments:

1 Implement basic Python programs for reading input from console.

2 Create Python built-in data types: Strings, List, Tuples, Dictionary, Set.

3 Data pre-processing (Removing missing data, Label encoding, Removing irrelevant features, Imputation).

4 Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types.

5 Data Loading using python.

6 Data visualization using Matplotlib, Seaborn package.

7 Build classification model using Support Vector Machine model.

8 Build classification model using Naïve Bayes model.

9 Build Prediction model using Linear Regression model.

10 Build Time series prediction model using ARIMA model.

L- 30 , P- 30, TOTAL HOURS - 60

TEXT BOOKS:

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson,2012.

REFERENCES

2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly, 2nd Edition,2018.

3. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, 2017.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: explore fundamentals of Data science using python.

CO2: discuss how to handle and process raw data in real world.

CO3: explain the need of visualization techniques in data analysis.

CO4: develop classification models and clustering models.

CO5: develop Prediction models for forecasting to solve real world problem.

	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	3	3	2	1	1	1							1	2
CO2	2	2	2	1	1	1							2	1
CO3	3	2	2	1	1	1							2	1
CO4	3	3	2	1	1	1							1	2
CO5	3	3	1	1	1	1							1	2

Note: 1- Low Correlation 2 - Medium Correlation 3 -High Correlation

SDG 13: Take urgent action to combat climate change and its impacts

Statement : Data science and analytics have a key role to play in achieving these sustainable development goals. They can be leveraged to enable sustainable development, particularly measuring impact, managing resources, tackling climate change, and more.

ITDX 55	MACHINE LEARNING USING R	L	T	P	C
SDG: 13		2	0	2	3

COURSE OBJECTIVES:

1. Understand the basic syntax, data types, and operations in R programming language..
2. Learn to import, clean, and preprocess datasets using R and acquire skills in data manipulation and transformation techniques with dplyr and tidyr packages.
3. Understand the principles of regression analysis and gain practical experience in implementing various regression algorithms for predictive modeling using R.
4. Explore classification algorithms and learn to build and evaluate classification models for various applications using R.
5. Develop an understanding of clustering techniques and gain familiarity with advanced analysis methods such as association rule learning and reinforcement learning.

MODULE I Introduction to R Programming and Data Import & Preprocessing **7**

Introduction to R programming language - Basic R syntax, data types, and operations - Introduction to RStudio IDE - Data import/export in R (reading CSV, Excel, and other file formats) - Exploring datasets and basic data manipulation techniques -Data wrangling with dplyr and tidyr packages - Data cleaning techniques (handling missing values, outliers) - Introduction to the ggplot2 package for data visualization

8

MODULE II Regression Analysis

Regression – Linear Regression – Multiple Linear Regression – Polynomial Regression – Support Vector Regression - Decision Tree Regression – Random Forest Regression - .

8

MODULE III Classification

Classification – Logistic Regression – K-Nearest Neighbour – Support Vector Machine – Kernal SVM – Naïve Bayes – Decision Tree classification – Random Forest Classification

MODULE IV Clustering and Advanced Analysis **7**

Clustering – K-Means Clustering – Hierarchical Clustering – Association Rule Learning – Reinforcement Learning - Natural language processing (NLP) - Time

series analysis and forecasting

Practical:

Exercises on the following topics:

1. R Programming Basics
2. Data Wrangling and Preprocessing
3. Data visualization
4. Regression Analysis using various Machine Learning Regression Algorithms.
5. Classification using various ML classification Algorithms
6. Clustering using K Means and Hierarchical Clustering Algorithms.
7. Association Rule Learning
8. Reinforcement Learning
9. Natural language processing (NLP)
10. Time series analysis and forecasting

L- 30 , P- 30, TOTAL HOURS - 60

TEXT BOOKS:

1 Hadley Wickham , Mine Çetinkaya-Rundeland Garrett Grolemund, “R for Data Science: Import, Tidy, Transform, Visualize, and Model Data”, O'Reilly Media, Second edition, 2023.

2 Chapman &Hall ,”Hands-On Machine Learning with R”, CRC, The Series, 2019.

REFERENCES:

1 Hefin I. Rhys , “Machine Learning with R, the tidyverse, and mlr“, Manning, 2020.

2 Nina Zumel, John Moun, “Practical Data Science with R”, Manning, 2014.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO 1 Write R code effectively, understand data types, and perform basic operations in the R programming language.

CO 2 be proficient in importing, cleaning, and preprocessing datasets using R, utilizing dplyr and tidyr packages for data manipulation and transformation.

CO 3 understand regression analysis principles and implement various regression algorithms in R for predictive modeling.

CO 4 explore classification algorithms, build classification models, and evaluate their performance for different applications using R.

CO 5 develop an understanding of clustering techniques, association rule learning, and reinforcement learning, and apply them to solve advanced analysis problems.

Board of Studies (BoS):
19th BoS of IT held on:22.5.2024

Academic Council:
22nd AC Meeting held on 4.9.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	L	M								H
CO2	M	L	H	L	L	H							M	
CO3	H	M	H	M	H	M							H	
CO4	M	H	M	M	L	M								M
CO5	M	H	L	M	M	M								H
CO6	L	M	L	M	L	M								L

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

SDG 13: Take urgent action to combat climate change and its impacts

Statement: Data science and analytics have a key role to play in achieving these sustainable development goals. They can be leveraged to enable sustainable development, particularly measuring impact, managing resources, tackling climate change, and more.

ITDX 56	DEEP LEARNING USING R	L	T	P	C
SDG: 13		2	0	2	3

COURSE OBJECTIVES:

1. To provide students with a solid understanding of the fundamental concepts and techniques in deep learning
2. To equip students with the knowledge and skills necessary to implement deep learning models using the Keras package in R.
3. To introduce students to advanced deep learning architectures and techniques
4. To enable students to apply deep learning techniques to solve real-world problems in domains such as image classification, natural language processing (NLP), time series analysis, and computer vision.

MODULE I Introduction to Deep Learning 6

Introduction to neural networks and deep learning - Basics of feed forward neural networks - Activation functions and loss functions - Gradient descent and back propagation - Implementing a simple neural network from scratch in R.

MODULE II Convolutional Neural Networks (CNNs) 8

Introduction to convolutional neural networks (CNNs) - Architecture of CNNs: convolutional layers, pooling layers, and fully connected layers - Image classification with CNNs using the Keras package in R - Transfer learning and fine-tuning pre-trained CNN models - Case studies and practical applications of CNNs in image recognition tasks.

MODULE III Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) Networks 8

Introduction to recurrent neural networks (RNNs) and their applications -
Architecture of LSTM networks and their advantages for sequential data processing - Text generation with RNNs and LSTM networks - Sentiment analysis and sequence classification with RNNs - Case studies and practical applications of RNNs and LSTM networks in natural language processing (NLP) tasks

MODULE IV Advanced Topics in Deep Learning 8

Advanced optimization techniques for training deep neural networks - Regularization techniques: dropout, L2 regularization - Generative adversarial networks (GANs) and their applications – Auto encoders and dimensionality reduction - Ethical considerations and challenges in deep learning.

Practical:

Exercises on the following topics:

1. Implementing a Feed forward Neural Network
2. Image Classification with Convolutional Neural Networks (CNNs)
3. Text Generation with Recurrent Neural Networks (RNNs)
4. Sentiment Analysis with Long Short-Term Memory (LSTM) Networks
5. Transfer Learning with Pre-Trained Models
6. Image Generation with Generative Adversarial Networks (GANs)
7. Autoencoders for Dimensionality Reduction
8. Advanced Optimization Techniques for Training Deep Learning Models
9. Interpretability and Explainability of Deep Learning Model

L- 30 , P- 30, TOTAL HOURS - 60

TEXT BOOK:

1. Francois Chollet and J.J. Allaire, "Deep Learning with R", Manning, First Edition, 2018

REFERENCES:

2. Michael Pawlus, "Hands-On Deep Learning with R ", Packt publishing, 2020.
3. Dr. PKS Prakash and Shaheen Ur Rehman, "R Deep Learning Cookbook", Packt Publishing, 2017..
4. David FosterShroff "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" O'Reilly, First Edition, 2019.
5. Christoph Molnar**,** "Interpretable Machine Learning: A Guide for Making Black Box Models Explainable" Lulu.com, 2020.
6. Adam Gibson and Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly, First Edition, 2019.

COURSE OUTCOMES:

On completion of the course, students will be able to

CO 1 Explain the foundational concepts in deep learning, including neural network architectures, activation functions, loss functions, and optimization algorithms like gradient descent and back propagation.

CO 2 implement deep learning models from scratch using the programming language R, demonstrating competence in constructing and training feed forward neural networks.

CO 3 design and deploy convolutional neural networks (CNNs) for tasks such as image classification, leveraging tools like the Keras package in R.

CO 4 work with sequential data using recurrent neural networks (RNNs) and Long Short-Term Memory (LSTM) networks.

CO 5 be proficient in tasks such as text generation, sentiment analysis, and sequence classification, particularly in the context of natural language processing (NLP) tasks.

CO 6 utilize generative adversarial networks (GANs) and auto encoders for tasks like image generation and dimensionality reduction.

Board of Studies (BoS) :
19thBoS of IT held on:22.5.2024

Academic Council:
22nd AC Meeting held on 4.9.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	L	M								H
CO2	M	L	H	L	L	H							M	
CO3	H	M	H	M	H	M							H	
CO4	M	H	M	M	L	M								M
CO5	M	H	L	M	M	M								H
CO6	L	M	L	M	L	M								L

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

SDG 13: Take urgent action to combat climate change and its impacts

Statement : Data science and analytics have a key role to play in achieving these sustainable development goals. They can be leveraged to enable sustainable development, particularly measuring impact, managing resources, tackling climate change, and more.

ITDX 57	GENERATIVE AI USING PYTHON	L	T	P	C
SDG: 13		2	0	2	3

COURSE OBJECTIVES:

1. To understand the fundamental concepts of generative models and Generative Adversarial Networks (GANs), and implement a basic generative model using PyTorch
2. To gain proficiency in advanced GAN architectures such as DCGAN, WGAN, and conditional GANs, and be able to implement these architectures using PyTorch for various applications.
3. To comprehend the principles of auto encoders and VariationalAutoencoders (VAEs), and implement these models using PyTorch for tasks such as image generation and anomaly detection.
4. To acquire knowledge of advanced topics in Generative AI, including sequence generation models, attention mechanisms, and Transformer architecture, and be able to implement these models using PyTorch for sequence generation tasks.

MODULE I Introduction to Generative AI 6

Overview of Generative Adversarial Networks (GANs) and generative models - Basics of probability theory and generative modeling - Introduction to PyTorch framework for deep learning - Implementing a simple generative model using PyTorch

MODULE II Advanced GAN Architectures 8

Deep dive into Generative Adversarial Networks (GANs): architecture, training dynamics, and applications - Variants of GANs: DCGAN, WGAN, CGAN, and conditional GANs - Implementing advanced GAN architectures in PyTorch - Evaluation metrics for assessing the quality of generated samples

MODULE III Autoencoders and VariationalAutoencoders (VAEs) 8

Introduction to autoencoders: architecture, training, and applications - VariationalAutoencoders (VAEs): principles, inference, and generation - Implementing autoencoders and VAEs using PyTorch - Applications of autoencoders and VAEs in image generation and anomaly detection.

MODULE IV Advanced Topics in Generative AI 8

Introduction to sequence generation: Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks - Attention mechanisms and Transformer architecture for sequence generation tasks - Implementing sequence generation models using PyTorch - Ethical considerations and societal impacts of

Generative AI.

Practical:

Exercises on the following topics using PyTorch

1. Implementing a Basic Generative Model
2. Training a Simple GAN
3. Implementing DCGAN
4. Conditional GANs Lab
5. Autoencoder for Image Reconstruction
6. VariationalAutoencoder (VAE) Lab
7. Sequence Generation with RNNs
8. Implementing Attention Mechanisms
9. Transformer Architecture Lab

COURSE OUTCOMES:

On completion of the course, students will be able to

CO 1 demonstrate a foundational understanding of generative models and techniques, as well as their applications in image generation, anomaly detection, and sequence generation

CO 2 implement advanced Generative Adversarial Network (GAN) architectures such as DCGAN, WGAN, and conditional GANs using PyTorch, and understand their strengths and limitations for various generative tasks

CO 3 implement auto encoders and VariationalAutoencoders (VAEs) using PyTorch, and apply these models to tasks such as image reconstruction, feature extraction, and probabilistic generative

CO 4 Implement sequence generation models, attention mechanisms, and Transformer architecture using PyTorch, and be able to apply these models to tasks such as language modeling, machine translation, and text generation

CO 5 develop and implement Generative AI projects using PyTorch

Board of Studies (BoS) :
19th BoS of IT held on:22.5.2024

Academic Council:
22nd AC Meeting held on 4.9.2024

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	L	L	L								H
CO2	M	L	H	L	L	L							M	
CO3	H	M	H	L	L	L							H	
CO4	M	H	M	L	L	M								M
CO5	M	H	L	L	M	M								H
CO6	L	M	L	M	L	M								L

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

SDG 13: Take urgent action to combat climate change and its impacts

Statement : Data science and analytics have a key role to play in achieving these sustainable development goals. They can be leveraged to enable sustainable development, particularly measuring impact, managing resources, tackling climate change, and more.

SPECIALIZATION IV

CLOUD COMPUTING

ITDX 61	**NEXTGEN TECHNOLOGIES**	**L**	**T**	**P**	**C**
SDG: 8		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

The Students will

COB1: understand the fundamental concepts of Next Generation Technologies like Cloud, Big Data, IoT and Social Media and Mobility, Machine learning, Artificial Intelligence and their impact on the industry.

COB2: study the concepts of cloud architecture and various services, technologies offered in Cloud, Big Data (Hadoop), Data Sciences, Data analyzing techniques, Structured data, Unstructured data.

COB3: learn the concepts of social media and how social Media is used for business.

COB4: understand the development of various mobile platforms, mobile apps and their operating systems.

COB5:discuss IoT, IPV6, and future of IoT and its uses across various industries.

MODULE I INTRODUCTION TO NEXT GENERATION TECHNOLOGIES 9

Introduction – Next-Generation Sequencing Technology – Computing Technology - Cloud Computing, Data Science Technology - Big Data, Internet of Things (IoT), Social Media and Mobility, Machine Learning-Artificial Intelligence (AI) – Diverse applications.

MODULE II CLOUD & BIG DATA 8

Cloud architectural overview – Cloud deployment models – Cloud service models – Cloud platforms – Managing data in the cloud – Computing in the cloud – Data Analytics in the cloud – Amazon Elastic Compute Cloud – Privacy and Security in Cloud – Data Visualization - Big data value for the enterprise – Structured and Unstructured data - Hadoop components – HDFS – Map reduce.

MODULE III SOCIAL MEDIA & MOBILE APPLICATIONS 10

Digital Social Media – Microblogging – Customer Personas - Social Networks – Social Bookmarking – Social Media Marketing – Social Media Profiling - Video Sharing and Podcasts – Live Streaming – REALLY Framework – Strategy Development – Gamification. Introduction – Mobile Platforms - Android Development Environment – XCode, Eclipse, VS2012 – App store, Google Play, Windows Store -

Mobile device application programming interfaces – Android/iOS/Win 8 Survival and basic apps – Impact on business cases.

MODULE IV INTERNET OF THINGS (IOT) 9

Introduction to IoT and Web of Things (WoT) – Business aspects of IoT – Industry domains - Making Things Smart – M2M to IoT - Cloud Computing for IoT - IoT Communication Protocols – IoT services or attributes - Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE V ARTIFICIAL INTELLIGENCE & MACHINE LEARNING 9

Foundations of AI & Machine Learning – Knowledge representation – Advanced search – Types of learning – Supervised – Unsupervised – Dimensionality Reduction – Machine Learning System Framing – ML Algorithms - Linear model – Distance based model – Tree and Rule models – Support Vector Machines – Neural networks – Robotic Process Automation – Machine learning tools – Octave/Matlab tutorial – A case study – Photo OCR – Game playing – Speech recognition.

L - 45; TOTAL HOURS –45

TEXT BOOKS:

1. Emmanuel Ameisen, Building Machine Learning Powered Applications, Orielly Publications, 2020.
2. RajkumarBuyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, John Wiley & Sons, Inc., Publications, 2011, E-book -2019.
3. RathinarajaJeyaraj ,GaneshkumarPugalendhi, Anand Paul, Big Data with Hadoop and Map Reduce, A class room approach, CRC Press, Sep 2020.
4. Ian Foster, Dennis B.Gannon, “Cloud Computing for Science and Engineering”, MIT Press, September 2017.

REFERENCES:

1. Rick Boyer, Android 9 Development Cookbook: Over 100 recipes and solutions to solve the most common problems faced by Android developers, 3rd Edition ,19 October 2018.
2. Programming iOS 14: Dive Deep into Views, View Controllers, and Frameworks, 4 December 2020.
3. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, John Wiley and Sons, 2014.
4. Luttrell, Regina, “Social Media: How to Engage, Share, and Connect”, Rowman& Littlefield Publishers, 2019.

5. Jeff McWherter, Scott Gowell, “Professional Mobile Application Development”, 2012.
6. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
7. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

CO1: describe the basics of various Next Generation Technologies.

CO2: explain cloud architecture, service & deployment models and basics of Big Data.

CO3: discuss digital social media and impact of social media on the business.

CO4: explain the fundamentals of IoT .

CO5: illustrate the basics of Artificial Intelligence and Machine Learning and apply some machine learning algorithms to solve simple problems.

Board of Studies (BoS) :
15th BoS of IT held on 16.12.2021

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	3	1	1	1	1	2				1		3	1	1
CO2	3	1	1	1	1	2				1		3	1	1
CO3	3	1	1	1	1	2				1		3	1	1
CO4	3	1	1	1	1	2				1		3	1	1
CO5	3	1	1	1	1	2				1		3	1	1

Note: 1- Low Correlation 2 -Medium Correlation 3 -High Correlation

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

Statement: The skills developed with the next generation technologies like IoT, AI & Machine Learning and analysis of social media networks leads to sustainable economic growth with productive employment and decent work for all.

ITDX 62	DISTRIBUTED COMPUTING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: Tounderstandthe classification of distributed systems.

COB2: To learn the communication models applied to distributed computing.

COB3: To know the synchronization and mutual exclusion concepts.

COB4: To learn the design of file systems for distributed data storage.

COB5: To understand the different consistency models.

MODULE I TYPESOFDISTRIBUTEDSYSTEMS **9**

Introduction - hardware concepts - bus based multiprocessor - switchedmultiprocessor – busbasedmulticomputer – switchedmulticomputer –softwareconcepts-networkoperatingsystems-True distributed system-Design issues – Trends in Distributed systems – Case Study – World wide web.

MODULE II COMMUNICATIONS **9**

Communication-Layered Protocols-Client server model – remoteprocedurecall – groupcommunication- System Models – physical models – architectural models.

MODULE III SYNCHRONIZATION & SECURITY **9**

Synchronization – ClockSynchronization – MutualExclusion-ElectionAlgorithms – Security techniques – Cryptographic algorithms – Digital Signatures.

MODULE IV DISTRIBUTEDFILESYSTEMS **9**

IntroductiontoDistributedfilesystems– Distributedfilesystemdesign– implementation–filemodels–faulttolerance–filereplication- Sun Network File System – Distributed Multimedia Systems – Case study-BitTorrent

MODULE V DISTRIBUTEDSHAREDMEMORY **9**

Consistency models–pagebaseddistributed sharedmemory-sharedvariabledistributedsharedmemory– Designing Distributed System – Google Case Study

L –45 ; TOTAL HOURS –45

TEXT BOOKS:

1. Andrew S.Tanenbaum and Maarten Van Steen, “Distributed Systems: Principles and Para: Principles and Paradigms”, Pearson Education 3

India, Second edition, 2015.
2. Coulouris George, Dollimore Jean, Kindberg Tim, Blair Gordon, "Distributed Systems – Concepts and Design", Pearson education, Fifth edition, 2017

REFERENCES:

1. Brendan Burns, "Designing Distributed Systems: Patterns and Paradigms for Scalable, Reliable Services", Shroff/O'Reilly publishers, Grayscale Indian Edition, 2018.
2. Wan Fokkink, "Distributed Algorithms An Intuitive Approach", PHI Learning Pvt. Ltd., Second edition, 2019.
3. AndrewS.Tanenbaum,"DistributedOperatingSystems",PearsonEducation Asia,2001.

COURSE OUTCOMES:

CO1: explain the hardware and software concepts of distributed systems.

CO2: analyze the communication protocols available for distributed systems.

CO3:describe the clock synchronization and mutual exclusion algorithms.

CO4:apply the design of distributed file systems to real world applications

CO5:identify appropriate consistency model for a distributed computing application.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12	PSO1	PSO2
CO1	3	2				1	1		1				1	2
CO2	3	3			2	2				2	2			2
CO3	3	1				1	1		1	1			1	
CO4	3	3	1		1						1	1	1	
CO5	3	1	1								1			

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

Statement : Understanding the concepts of communication protocols in distributed environments and organizing data in distributed file systems helps to access the compute and storage resources across geographical location for any real world application.

ITDX 63	VIRTUALIZATION TECHNIQUES	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To know the underlying concepts of virtualization.

COB2: To understand the techniques of server virtualization.

COB3: To learn about network and storage virtualization

COB4: To create virtualization environment for hosting applications.

MODULE I INTRODUCTION 10

Describing virtualization – Virtualization and cloud computing – Virtualizing Servers, Desktops and applications – Hypervisor – Types – Type 1 and Type 2 Hypervisor – Describing a virtual machine – Examining CPUs – memory – network - storage resources in Virtual Machine.

MODULE II SERVER VIRTUALIZATION 10

Building a VM – Loading Windows / Linux on a VM – Managing CPUs for a VM – CPU virtualization – Configuring VM CPU options – Tuning Practices - Sever Virtualization- Physical and Logical Partitioning – Business cases for Sever Virtualization - Uses of Virtual server Consolidation - Selecting server Virtualization Platform.

MODULE III NETWORK AND STORAGE VIRTUALIZATION 10

Understanding Storage Virtualization – Configuring VMStorage Options-Tuning Practices for VMStorage – Managing Networking for a Virtual Machine – Understanding Network Virtualization – Configuring VMNetwork Options – Tuning Practices for Virtual Networks – Copying a Virtual Machine –Cloninga Virtual Machine – Working withTemplates – Saving a Virtual Machine State.

PRACTICALS 30

List of Experiments

1. Study of Virtualization Software
2. Create Type 2 Virtualization environment in VMware. Allocate the appropriate resources for the created VM
3. Setting up of Windows / Linux / Ubuntu VMs and configure VM CPU options

4. Create and Manage Snapshots for VMS.
5. Creation of VM Images, VM Template and VM Networks
6. Execute a simple program using any language in the configured VM
7. Implement Data transfer between the configured Virtual Machines.
8. Configuration of storage resources for VM
9. Network configuration for VMs.

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOKS:

1. MatthewPortnoy,"VirtualizationEssentials", Second edition, Sybex, 2016.
2. Prashanta Kumar Das, Ganesh Chandra Deka, “Design and Use of Virtualization Technology in Cloud Computing”, IGI Global Publishers, 2018.

REFERENCES:

1. Gustavo Alessandro Andrade Santana, “Data Center Virtualization Fundamentals”, First edition, Cisco Systems, 2013.
2. Amy Newman, Kenneth Hess, “Practical Virtualization Solutions: Virtualization from the Trenches”, Prentice Hall, October 2009.

COURSE OUTCOMES:

CO1: Explain the role of hypervisor and its types.

CO2: Select server virtualization platforms for business scenarios.

CO3: Discuss the storage and network virtualization applied in data centres.

CO4: Build a virtual machine to deploy applications in virtual environment.

CO5: Analyze the different types of virtualization employed for real time application scenarios.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

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

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

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

ITDX 64	FOG COMPUTING	L	T	P	C
SDG - 8		2	0	2	3

OBJECTIVES:

COB1: Study the fundamental concepts of Fog.

COB2: Understand the architecture and components of Fog.

COB3: Analyze the protocols of Fog.

COB4: Understand the data management and Fog security principles.

COB5: Apply the case studies related to Fog Computing

MODULE I INTRODUCTION TO FOG COMPUTING **10**

Fog Computing - Definition Characteristics - Application Scenarios - Issues - Fog Computing and Internet of Things – Fog Computing Components - Fog Computing and Cloud Computing - Simple Case Studies High Level and Software Architecture.

MODULE II FOG COMPUTING FUNDAMENTALS **10**

Introduction – Background and Motivation of Fog Computing – Fog Computing Basics – Fog Computing Services. IoT Resource Estimation Challenges and Modeling in Fog: Fog Resource estimation and its challenges.

MODULE III FOG COMPUTING IN SUPPORT OF HIERARCHICAL EMERGENT BEHAVIORS **10**

Introduction – Fog Computing – Hierarchical Emergent Behaviors, Two Autonomous Vehicles Primitives Case Study. The Present and Future of Privacy-Preserving Computation in Fog Computing: Introduction – Block Chain – Multi-Party Computation. Leveraging Fog Computing for Healthcare IoT: Introduction – Healthcare Services in the Fog Layer – Data management – Event Management – Resource Efficiency – Device management – Personalization – Privacy and Security – System Architecture of Healthcare IoT.

L –30 ; P – 30 ; TOTAL HOURS – 60

PRACTICAL:

List of Experiments

1. Study of basic tools of Fog Computing.
2. Configure compute with edge development on Linux using open

source.

3. Implement and create the first Quarkus application
4. Email Forensics - Tracing E–mail–Finding senders IP Address of received e–mail, tracing route of e–mail received using tools available on internet using Visual Trace Route.
5. Locate a deleted mail using Forensic Tool Kit.
6. Storage media forensics.
7. Image Analysis & Steganography using tools like Merge Streams, Image Hide, Stealth Files,Blindside, Stools.
8. Network Forensics Analysis – Capture and analyze network traffic using network traffic/data capturing/monitoring tools like NetWitness, Windump, Network Flight Recorder.

TEXT BOOKS:

1. Assad Abbas, Samee U. Khan, Albert Y. Zomaya," Fog Computing: Theory and Practice", Publisher(s): Wiley, ISBN: 9781119551690, April 2020.
2. Dr. ZaighamMahmood," Fog Computing: Concepts, Frameworks and Technologies", Springer; 1st ed. 2018 edition (23 July 2018)

REFERENCES:

1. Amir M. Rahmani, PasiLiljeberg, Preden, Axel Jantsch, —Fog Computing in the Internet of Things - Intelligence at the Edge‖, Springer International Publishing, 2018.

COURSE OUTCOMES:

CO1: Discuss the fundamental concepts in Fog.
CO2: Analyze the architectures available in Fog.
CO3: Know and explain the Protocols related to Fog.
CO4: Examine the case studies of Fog.
CO5:Acquire the knowledge of fog computing and use of IoT in fog computing

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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

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

Statement : The problem solving methodologies fog computing helps to solve problems associated with any engineering domain and provides appreciable solution to real world problems.

ITDX 65	CLOUD SERVICES AND PLATFORMS	L	T	P	C
SDG: 8		2	0	2	3

COURSE OBJECTIVES:

COB1: To learn the functionalities of Elastic Compute Cloud in AWS

COB2: To know the concepts of compute engine and Kubernetes engine in GCP.

COB3: To understand the compute and storage services of Microsoft Azure.

COB4: To build an application and host in any of the cloud platforms.

MODULE I AWS 10

Amazon web services cloud platform – EC2 – Elastic container service – Storage - Simple storage service – Elastic file system – Migration and transfer – Developer tools.

MODULE II GOOGLE CLOUD PLATFORM 10

Google cloud platform – Building an application for cloud – Compute engine – Virtual Machines – Kubernetes engine – App engine- Fully managed applications.

MODULE III MICROSOFT AZURE 10

Getting access to Microsoft azure – Azure compute – Azure storage services – Virtual networks -Monitoring and Security – Managing Azure.

PRACTICALS 30

List of Experiments:

1. Launching EC2 templates with basic configurations
2. Configure compute optimized instances for gaming servers and Web applications.
3. Configure storage optimized instances for large data sets on local storage.
4. Implement the load balancer to accept the incoming requests and allocate to available resources.
5. Setting up of Google cloud platform for Infrastructure as a service.
6. Planning and configuring a Google cloud platform solution
7. Using GCP Labs library, set up a cloud environment for a simple application.
8. Configure Microsoft Windows Azure VM(Linux) from Azure Portal.
9. Use the core Azure storage products for storage services of an application.
10. Learn Role-based access control for Microsoft Azure Cloud

L – 30 ; P – 30 ; TOTAL HOURS – 60

TEXT BOOKS:

1. Raoul Alongi,"AWS: The Most Complete Guide to Amazon Web Services from Beginner to Advanced Level", Independently published , 2019.
2. JJ Geewax , "Google Cloud Platform in Action", first edition, Manning Publications, 2018.
3. John Savill, "Microsoft Azure Infrastructure Services for Architects: Designing Cloud Solutions", first edition, Sybex, 2019.

REFERENCES:

1. Richard Derry, "Amazon Web Services: The Complete Guide From Beginners For Amazon Web Services", Independently published, 2019.
2. Dan Sullivan, "Official Google Cloud Certified Associate Cloud Engineer Study Guide", first edition, Sybex, 2019.
3. Jim Cheshire, "Exam Ref AZ-900 Microsoft Azure Fundamentals", second edition, Microsoft Press, 2020.
4. https://cloudacademy.com/ , https://www.w3schools.com/aws/

COURSE OUTCOMES:

CO1: Implement EC2 and S3 of AWS for a user application.

CO2: Work with GCP and deploy a application in Compute cloud.

CO3: Discuss the components of Microsoft azure platform.

CO4: Deploy an application with necessary compute and storage resources.

CO5: Design cloud based solution for compute / storage requirements of an organization.

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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

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

Statement : Developing cloud based solutions and implementing in any cloud platforms like AWS, Microsoft Azure or Google cloud platforms provides a shift from conventional computing and provides better financial gain to It and ITES industries.

SPECIALIZATION V

CYBER SECURITY

ITDX71	**CRYPTOGRAPHY AND NETWORK SECURITY**	**L**	**T**	**P**	**C**
SDG: 16		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To Understand Cryptography, Steganography Algorithms and systems.
COB2: To study the various approaches to Symmetric Encryption Techniques.
COB3: To be acquainted with Asymmetric Encryption, Digital Signature Standard and provide solutions for their issues
COB4: To be familiar with various message authentication and Integrity Algorithms

COB5: To understand the security issues at network layer and the countermeasures.

MODULE I INTRODUCTION 9

Security Goals-Attacks-Services and Mechanisms-Techniques- -The OSI Security Architecture — Classical encryption techniques: substitution techniques, transposition techniques, Rotor Machines-steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

MODULE II SYMMETRIC ENCRYPTION TECHNIQUES 9

Mathematics of Cryptography -Integer Arithmetic-Modular Arithmetic-Matrices-B Finite fields -Block Ciphers and Data Encryption Standard – Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Strength of DES – Linear and Differential Analysis-Block Cipher Design Principles-Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Block Cipher mode of Operation-RC4-Confidentiality using Symmetric encryption-Key distribution.

MODULE III ASYMMETRIC ENCRYPTION TECHNIQUES 9

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing –

Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – Public- Key Cryptography and RSA – Principles of Public Key Cryptosystem – RSA Algorithm – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography- Pseudo Random Generation.

MODULE IV MESSAGE AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509.

MODULE V SECURITY 9

E Mail-PGP-S/MIME-SSL Architecture-Four Protocols-SSL Message Formats-TLS -Generation of Cryptographic Secrets-Alert and Handshake protocols- IP security-IPSec..

L – 45; TOTAL HOURS – 45

TEXT BOOKS:

1. Williams Stallings, “Cryptography and Network Security: Principles and Practice “, th7 Edition, ISBN: 10:1-292-15858-1, 2016.

REFERENCES:

1.Behrouz A.Forouzan, “Cryptography and Network Security”, Tata McGraw Hill 2007.

2. AtulKahate,” Cryptography and Network Security” Tata McGraw Hill 2006.

COURSE OUTCOMES:

CO1: Understand the various Encryption techniques, Design Principles and Modes of Operation.

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms.

CO3: Develop different cryptographic operations of public key cryptography and key management Techniques.

CO4: Examine the various Authentication schemes to simulate different applications.

CO5: Understand various Security practices and System security standards .

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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.

Statement: Cryptography can reformat and transform our data, making it safer on its trip between computers. The main aim of any organization is to protect their data from attackers. Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources

ITDX 72	SECURITY ANALYST FUNDAMENTALS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: Gain knowledge on fundamental concepts of security analyst.

COB2: Apply appropriate skills and knowledge in analyzing threats

COB3: Apply theoretical and practical knowledge in vulnerability into the future.

COB4: Familiarize the basics of Digital Forensics.

COB5: Analyze the legal, ethical and professional issues in Cyber Crime.

MODULE I FUNDAMENTALS OF DEFENDING SYSTEMS 9

Introduction - Core Frameworks and Principles – Controls - Defensible Network Architecture.

MODULE II ANALYZING SECURITY THREATS 9

Identifying Security Threats - Mitigating Threats - Threat Modeling - Email Investigations – Cell Phone and Mobile Devices Forensics.

MODULE III ASSESSING VULNERABILITIES AND REDUCING RISK 9

Understanding Vulnerabilities - Assessing Vulnerabilities - Determining Risk and Business - Impact Managing and Mitigating Risk.

MODULE IV MONITORING, LOGGING AND RESPONDING TO INCIDENTS 9

Incident Detection - Monitoring and Logging - Incident Handling - Digital Forensic Methodologies - Forensics Software and Hardware tools.

MODULE V SYSTEMS INVESTIGATION AND ETHICAL ISSUES 9

Data Analysis Techniques - Investigating Live Systems (Windows &Unix) - Investigating Hacker Tools - Ethical Issues – Cybercrime.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Bodie, Z., A. Kane and A.J. Marcus. (2002). Investments. New York: McGraw-Hill Companies, Inc. Decasa, L.M. (2013).

REFERENCES:

1. Securities Regulation Code (Republic Act No. 8799): Annotated with Implementing Rules and Regulations. Manila: Rex Book Store.
2. Graham, B. and D.L. Dodd. (2009). Security Analysis: Principles and

Technique. New York: McGraw Hill Companies, Inc.
3. Reilly, F.K. and K.C. Brown. (1997). Investment Analysis and Portfolio Management. Fort Worth: The Dryden Press.

COURSE OUTCOMES:

CO1: Understand the basics of security analyst

CO2: Apply the different tools to identify the threats

CO3: Identify the vulnerabilities in a given network infrastructure

CO4: Know how to apply forensic analysis tools to recover important evidence for identifying cloud crime

CO5: Implement real-world hacking techniques to test system security

Board of Studies (BoS) : 16thBoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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

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

Statement : By building financial models on the data, a security analyst can better understand the financial health and profitability prospects of a company or sector.

ITDX 73	ETHICAL HACKING	L	T	P	C
SDG: 08		2	0	2	3

OBJECTIVES:

COB1: To learn the fundamentals of hacking.

COB2: To introduce port scanning and vulnerability assessment.

COB3: To know about network sniffing using various tools.

COB4: To explore the current techniques and tools for web hacking.

COB5: To test the system by performing the various attacks.

MODULE I INTRODUCTION TO HACKING 7

Important Terminologies - Categories of Penetration Test - Writing Reports - Structure of a Penetration Testing Report- Risk Assessment & Methodology - Information Gathering Techniques - Active & Passive Information Gathering - Sources of Information Gathering - Copying Websites Locally - Interacting with DNS Servers

MODULE II PORT SCANNING & VULNERABILITY ASSESSMENT 8

Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - TCP Three-Way Handshake – TCP Connect Scan - UDP Port Scan - IDLE Scan - Vulnerability Scanners - Pros and Cons - Vulnerability Assessment with Nmap - Updating the Database - Testing SCADA Environments with Nmap - Nessus Vulnerability Scanner - Installing Nessus on BackTrack - Port Range

MODULE III NETWORK SNIFFING 8

Introduction - Types of Sniffing – Hubs versus Switches - Promiscuous versus Nonpromiscuous Mode - MITM Attacks - ARP Attacks - Denial of Service Attacks - ARP Spoof to Perform MITM Attacks - Sniffing the Traffic with Dsniff - Sniffing Pictures with Drifnet - Urlsnarf and Webspy - Sniffing with Wireshark - Hijacking Session with MITM Attack - Real-Life Example

MODULE IV WEB HACKING 7

Attacking the Authentication - Brute Force and Dictionary Attacks - Types of Authentication - Password Reset Vulnerability - Crawling Restricted Links - Testing for the Vulnerability - Authentication Bypass with Insecure Cookie Handling - SQL Injection attacks - Testing for SQL Injection - Real-World Example

PRACTICAL

- DoS and DDOS attacks
- Website penetration testing
- System penetration testing
- SQL injection attack
- Man in the middle attacks
- Social engineering
- Writing ethical hacking tools with Python

L – 30; P – 30, TOTAL HOURS – 60

REFERENCES:

1. RafayBaloch, Ethical Hacking And Penetration Testing Guide, CRC Press, 2015.
2. John Slavio, Hacking: A Beginners' Guide to Computer Hacking, Basic Security and Penetration Testing, 2017.
3. Peter Kim, The Hackers Playbook 2 - Practical Guide To Penetration Testing, Secure Planet LLC, 2015.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1: Explore the general hacking methods.

CO2: Accomplish port scanning and vulnerability assessment.

CO3: Monitor network traffic using various sniffing tools.

CO4: Perform web hacking and test for vulnerability.

CO5: Accomplish various attacks and handle them using various tools.

CO6: Use the ethical hacking tools.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	L	L	L								M	H
CO2	M	M	M	L	M								M	H
CO3	M	M	M	M	H								M	H
CO4	M	M	M	M	H								M	H
CO5	M	M	M	M	H								M	H
CO6	M	L	M	L	H								M	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 knowledge of the Ethical Hacking leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 74	BLOCKCHAIN TECHNOLOGY	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the problems solved by Blockchain.

COB2: To learn how technology can make institutions faster and less expensive.

COB3: To analyse how Blockchain increase security for transactions and contracts.

COB4: To gain knowledge about bitcoins and problems in bitcoins.

COB5: To understand about cryptographic hash functions.

MODULE I INTRODUCTION TO BLOCKCHAIN 9

Introduction- Replacing institutions with technology – New technological paradigm Security and privacy – Crptography – Blockchain future – finance, Governance, crowdfunding, Insurance.

MODULE II PRINCIPLES OF BLOCKCHAIN 9

Working of Blockchain – Distributed Ledgers- Creating a Block- Adding Transactions-Compiling the Ledger – Time stamp and BlockID – Linking Blocks together.

MODULE III CRYPTOGRAPHIC HASH FUNCTIONS 9

Working of Blockchain hashing- Cryptographic hash functions – High level overview of hashing in proof of work- Proof of stake – other consensus mechanisms.

MODULE IV MINING BITCOIN 9

Mining a Bitcoin block by hand- Bitcoin history – story of Satoshi – Bitcoin Scalability problem – wait times –restricted block size.

MODULE V BLOCKCHAIN CATEGORIES & TECHNOLOGIES 9

Blockchain categories- Challenges of Blockchain technology – Introduction to Blockchain programming – Potential of Blockchain – Governments and Blockchain - Bitcoin cash – Litecoin – Privacy coins – Dash – Hyperledger – IOTA – Ripple.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Alan T.Norman, “Blockchain Technology Explained – The Ultimate Beginner’s Gide”,CreateSpace Independent Publishing Platform,

2017

2. Mark Atwood, “Blockchain Technology Explained”, CreateSpace Independent Publishing Platform, 2018.

REFERENCES:

1. Antony Lewis. ‘The Basics of Bitcoins and Blockchains: An introductior to Cryptocurrencies and the Technology that Powers Them”, two rivers distribution publishers, 2019.
2. Mark Gates, “Blockchain: Ultimate Guide to Understanding Blockchain Bitcoin, Cryptocurrencies, Smart Contracts and the Future of Money”, CreateSpace Independent Publishing Platform, 2017.
3. Jeff Reed, “Blockchain: The Essential Guide to Understanding the Blockchain Revolution”, CreateSpace Independent Publishing Platform 2016.

COURSE OUTCOMES:

On completion of the course, students will be able to:

CO1:Discuss about how to use Blockchain technology in various domains.

CO2: Explain the working of blockchain technology with various elements

CO3: Describe the cryptographic hash function in proof-of-work algorithm

CO4: Illustrate the concepts of Bitcoin mining and discuss their issues

CO5: Discuss about the various blcokchain technology and analyze the challenges and potential bottlenecks for developing real world applications.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		2									1	2
CO2	2	2											2	1
CO3	2	2	1	2			1						1	2
CO4	2	2		2									1	2
CO5	2	2	1	2	2	1							2	2

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

SDG4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Understanding the concept of Blockchain Technology and its applications and analyzing the significance of it enable both the genders to get a quality education and promote their lifelong learning opportunities in the fastly growing internet field.

ITDX 75	SECURITY IN COMPUTING	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To understand the basics of cryptography techniques.

COB2: To know the techniques and motivations used by hackers.

COB3: To explore the technological aspects of program and web security.

COB4: To know the security mechanism given by operating system.

COB5: To discover the network level security.

COB6: To study the critical need for ensuring Information Security in database.

MODULE I CRYPTOGRAPHY 9

Introduction - Computer Security – Threats - Harm – Vulnerabilities – Controls - Authentication - Access Control – Cryptography – Symmetric key & Asymmetric key encryption – Digital signatures.

MODULE II CYBER ATTACKER TECHNIQUES AND MOTIVATIONS 8

Hackers Covering Their Tracks, Proxies, Tunnelling, Fraud Techniques, Phishing, Smishing, Vishing, Mobile Malicious Code, Rogue Antivirus, Click Fraud, Threat Infrastructure, Botnets, Honeypots

MODULE III PROGRAM & WEB SECURITY 9

Unintentional (Nonmalicious) Programming errors – Malicious code – Malware - Viruses, Trojan Horses, and Worms – Countermeasures - The Web - Browser Attacks - Web Attacks Targeting Users - Email Attacks.

MODULE IV OPERATING SYSTEM SECURITY 9

Memory and Address Protection - File Protection Mechanisms - User Authentication - Trusted Operating Systems - Designing Trusted Operating Systems- Assurance in Trusted Operating Systems

MODULE V NETWORK AND DATABASE SECURITY 10

Network Security Attacks - Threats to Network Communications - Wireless Network Security - Denial of Service - Security Countermeasures - Cryptography in Network Security – Firewalls - Intrusion Detection and Prevention Systems - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

L – 45 ; TOTAL HOURS – 45

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th Edition, Pearson Education, 2015.
2. William Stallings, "Cryptography and Network Security - Principles and Practices", 3rd Edition, Pearson Education, 2003.
3. AtulKahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.
4. James Graham, “Cyber Security Essentials”, CRC Press, 2011.

COURSE OUTCOMES:

Uponcompletionofthiscourse, students will be able to

CO1: Discuss the various cryptographic techniques in Information Security

CO2: Use the security measures to identify the motivations of attackers.

CO3: Identify program level malicious code and provide control measures.

CO4: Discuss operating system level security to assess trusted operating systems.

CO5: Explain threats in network level scenarios.

CO6: Outline database security requirements in multilevel databases.

Board of Studies (BoS) :
16th BoS of IT held on 18.08.2022

Academic Council:
19th AC held on 29.09.2022

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L										M	H
CO2	M	M	M	L									M	H
CO3	M	M	M	L	H								M	H
CO4	M	M	L	L									M	H
CO5	M	M	L										M	H
CO6	M	M	L										M	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 knowledge of the Security in Computing leads to inclusive and sustainable economic growth, full and productive employment for the students.

ITDX 76	CYBER FORENSICS	L	T	P	C
SDG: 8		3	0	0	3

COURSE OBJECTIVES:

COB1: To learn computer forensics

COB2: To become familiar with forensics tools

COB3: To learn to analyze and validate forensics data

COB4: To understand the concept of ethical hacking

COB5: To apply the ethical hacking in the real world applications

MODULE I INTRODUCTION TO COMPUTER FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

MODULE II EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

MODULE III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

MODULE IV ETHICAL HACKING 9

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing.

MODULE V ETHICAL HACKING IN WEB 9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

L – 45 ; TOTAL HOURS – 45

TEXT BOOKS:

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations‖, Cengage Learning, India Edition,2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

1. John R.Vacca, —Computer Forensics‖, Cengage Learning, 2005 MarjieT.Britz, —Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013.
2. AnkitFadia — Ethical Hacking‖ Second Edition, Macmillan India Ltd, 2006
3. Kenneth C.Brancik —Insider Computer Fraud‖ Auerbach Publications Taylor & Francis Group–2008.

COURSE OUTCOMES:

CO1: Understand the basics of computer forensics

CO2: Apply a number of different computer forensic tools to a given scenario

CO3: Analyze and validate forensics data

CO4: Identify the vulnerabilities in a given network infrastructure

CO5: Implement real-world hacking techniques to test system security

Board of Studies (BoS) : 16th BoS of IT held on 18.08.2022

Academic Council: 19th AC held on 29.09.2022

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

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

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

Cyber Forensics is to implement good governance on cybersecurity, using appropriate tools and metrics, will be less resilient and less sustainable.

PHYSICS ELECTIVE (II SEMESTER)

		L	T	P	C
PHDX 01	**NON DESTRUCTIVE TESTING OF MATERIALS**				
SDG: 4		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

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

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

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

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

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

MODULE I SURFACE NDT METHODS 7

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

MODULE II THERMOGRAPHY AND EDDY CURRENT TESTING 7

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

MODULE III RADIOGRAPHY 8

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square law, characteristics of films -graininess, density, speed, contrast, characteristic curves. Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Digital Radiography.

MODULE IV ULTRASONIC TESTING 8

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

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

CO4: Assimilate the ideas concerning the principle, types of waves, instrumentation, standards, calibration methods of ultrasonic NDT methods and identify the areas for their application.

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

PHDX 02	MATERIALS SCIENCE FOR ENGINEERING (For Polymer)	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

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

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

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

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

MODULE I CLASSIFICATION OF MATERIALS 6

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

MODULE II PROPERTIES OF MATERIALS 10

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

MODULE III CRYSTALLOGRAPHIC STRUCTURES AND IMPERFECTIONS 7

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

MODULE IV THERMODYNAMICS AND KINETICS 7

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

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES

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

CO1:select suitable material for specific application.

CO2: analyse crystallographic structure of metals and their imperfections.

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

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

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

PHDX 03	BIOMATERIALS	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

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

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

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

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

MODULE I INTRODUCTION TO BIOMATERIALS 8

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

MODULE II IMPLANT MATERIALS 10

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

MODULE III BIOCOMPATIBILITY AND TOXICOLOGICAL SCREENING OF BIOMATERIALS 6

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

MODULE IV PRACTICAL ASPECTS OF BIOMATERIALS 6

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

biomaterials.

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

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

CO1: differentiate common use of biomaterials as metals, ceramics, polymers and apply them to classify its chemical structure, properties and morphology.

CO2: comprehend ideas involving general properties of implant materials and apply the same to identify the benefits of implant materials.

CO3: attain knowledge about the biocompatibility & toxicological screening of biomaterials and realize its usage in real life.

CO4: reflect upon the practical ideas of using biomaterials

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	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	L	M	L	M	M	M	L	L	L	M	-	-	-
CO2	M	L	M	L	L	M	M	M	L	L	L	M	-	-	-
CO3	M	L	H	H	L	H	M	M	L	H	L	M	-	-	-
CO4	M	L	H	M	L	M	M	M	L	M	L	M	-	-	-

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

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

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

PHDX 04	OPTICAL FIBRE COMMUNICATION	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1:To facilitate the knowledge about optical fibres and its transmission characteristics.

COB2:To make the students to learn about LED and laser diodes.

COB3:To make the students understand the various types of opticalReceiversand sensors.

COB4:To enrich the knowledge on optical amplifiers and networks.

MODULE I INTRODUCTION TO OPTICAL FIBRES 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers.

MODULE II FIBER OPTICAL SOURCES 7

Light Emitting Diodes (LED) – power and efficiency - double hetero LED – LED structure - LED characteristics – Semiconductor Lasers diode, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers - applications.

MODULE III FIBER OPTICAL RECEIVERS AND SENSORS 8

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film solar cells, amorphous silicon solar cells - Fiber optic sensors: Intrinsic and Extrinsic sensors, amplitude, phase, wavelength and polarization modulation.

MODULE IV OPTICAL AMPLIFIERS AND NETWORKS 8

Optical amplifiers, Semiconductor optical amplifiers, Erbium-doped fiber amplifiers - Optical Networks: Basic networks, SONET/SDH, WDM Networks, Nonlinear effects on network performance, Performance of WDM + EDFA systems, Solitons, Optical CDMA, Ultrahigh capacity networks.

L – 30; Total Hours –30

TEXT BOOKS:

1. Gerd Keiser, Optical Fiber Communication, 3rd Edition, McGraw-Hill International, Singapore, 2013.

REFERENCES:

1 Govind P. Agrawal, Fiber-Optic Communication Systems (Wiley Series in Microwave and Optical Engineering) , Wiley 4th Edition, 2010.
2 J. Senior, Optical Communication, Principles and Practice, Prentice Hall of India, 3rd Edition, 2010.
3 D. C. Agrawal, Fiber Optic Communication, S.Chand& Co Ltd., 2005.
4 Rajiv Ramaswami, KumarSivarajan, Galen Sasaki, Optical Networks: A Practical Perspective, 3rd Edition, Morgan Kaufmann, 2009.
5 B. Culshaw, Optical Fiber Sensing and Signal Processing, Peter Peregrinus Ltd, 2014.

COURSE OUTCOMES:

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

CO1: realize basics of optical fiber and differentiate various modes andconfigurations.

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

CO3: select suitable photodetectors/sensorsfor different types of applications.

CO4: analyze the mechanism of optical amplifiers and analyze opticalnetworks.

Board of Studies (BoS) : BOS of Physics was held on 21.6.21

Academic Council: 17th AC held on 15.07.2021

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

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

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

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

PHDX 05	**SEMICONDUCTOR PHYSICS FOR**	**L**	**T**	**P**	**C**
SDG: 4	**INFORMATION TECHNOLOGY**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

COB1:To understand the physics of semiconductor devices

COB2:To gain knowledge on various methods involved in nanofabrication of semiconductor devices

COB2:To study the working principle of optoelectronic devices andvarious display devices

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

MODULE I INTRODUCTION TO SEMICONDUCTOR DEVICES 6

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

MODULE II FABRICATION OF SEMICONDUCTOR DEVICES 6

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

MODULE III OPTOELECTRONIC DEVICES 10

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

MODULE IV MEMORY STORAGE DEVICES 8

Introduction to memory storage, Resistive Random Access Memory (ReRAM), Phase Change Memory (PCM); Magnetoresistive Random Access Memory (MRAM)- Gaint Magnetoresistance (GMR), Tunnel Magnetoresistance (TMR), Ferroelectric Random Access Memory (FeRAM); Comparison and future directions, Hardware circuits, working analysis.

L – 30; Total Hours –30

TEXT BOOKS:

1) W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate(Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2) Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3) D. S. Dhaliwal et al., Prevail :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

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

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

Board of Studies (BoS) : BOS of Physics was held on 21.6.21

Academic Council: 17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	L	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

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PHDX 06	SENSORS AND ACTUATORS	L	T	P	C
SDG: 4		2	0	0	2

COURSE OBJECTIVES:

COB1: To understand the basic concept of sensors towards detection of pressure, position, velocity and temperature.

COB2: To avail knowledge on sensor which are sensitive to light, magnetic field, and acoustic waves

COB3: To study the different types of fabrication techniques towards realization of various sensors.

COB4: To get introduced towards MEMS technology and various actuators.

MODULE I INTRODUCTION TO SENSORS: PRESSURE, POSITION, VELOCITY AND TEMPERATURE 8

Introduction to sensors – working principles– classification – static and dynamic characteristics, Error Analysis, Pressure sensors – strain gauge, piezoelectric force sensor, vacuum sensors, Position sensor -Proximity sensor, Capacitive, Inductive and displacement sensor, velocity and acceleration sensors, Temperature sensor-thermocouples- thermistors-Thermo-EMF Sensors, metal Junction and metal Semiconductor junction types.

MODULE II SENSORS : LIGHT, MAGNETIC FIELD AND ACOUSTIC 8

Photocondutors- Optical Detectors - Photodiodes, Phototranistors, Optical encoder-Charge Coupled Device (CCD), Fabry Perot sensor, Hall effect, magneto resistive, magneto strictive sensors, Acoustic sensors-microphones-resistive, capacitive, piezoelectric, fiber optic, solid state - electrect microphone.

MODULE III SENSORS FABRICATION TECHNIQUES 7

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

MODULE IV MICROSYSTEMS AND ACTUATORS 7

Microelectro-mechanical systems (MEMS) - RF- MEMS, Micro fabrication and Applications, Classification of transducers: electrostatic, piezoelectric, thermal, Microsystem design and fabrication.working principles of Actuators.

Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications Solid-state switches, relays Solenoids, D.C. Motors, A.C. Motors, Stepper motors. Shape memory alloy actuators.

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

1. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate (Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 3rd Edition, 2018
2. Chris Mack, Fundamental Principles of Optical Lithography: The Science of Microfabrication, Wiley, 2008
3. D. S. Dhaliwal et al., PREVAIL :Electron projection technology approach for next-generation lithography, IBM Journal Res. & Dev. 45, 615, 2001.
4. Tai-Ran Hsu, MEMS & Microsystem, Design and Manufacture, 1st ed., McGraw Hill India, New Delhi, 2017.
5. MassoodTabibArar, Microactuators – Electrical, Magnetic Thermal, Optical, Mechanical, Chemical and Smart structures, 1st ed., Kluwer Academic publishers, New York, 2014.

COURSE OUTCOMES:

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

CO1: get exposed to various types of sensors and apply the ideas to distinguish between pressure, position, velocity and temperature based sensors

CO2: familiarize towards light, magnetic field, and acoustic based sensors and recognize their importance in commercial applications.

CO3: gain insight into various fabrication techniques towards the realization of sensors

Board of Studies (BoS) : BOS of Physics was held on 21.6.21

Academic Council: 17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	L	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

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

COURSE OBJECTIVES:

COB1:To introduce the basic concepts of Nanoscience through quantum mechanical theories and solid state physics.

COB2: To provide knowledge about the various synthesis methods applicable to different nano materials

COB3:To enrich the knowledge of students in various characterisation techniques.

COB4:To provide knowledge on applications of poymer based nano materials in various fields.

MODULE I BASICS OF NANO SCIENCE 7

Introduction to Nanoscience & Nanotechnology : Review of classical mechanics – overview Quantum Mechanics. Background to nanoscience and nanotechnology - scientific revolutions - nanosized effects – surface to volume ratio – atomic structure – molecular and atomic size - quantum effects - formation of nano sized particles – energy at the nanoscale.

MODULE II SYNTHESIS OF NANOMATERIALS 8

Nanomaterial Fabrication: Bottom-up vs. top-down - Preparations of Nanomaterials by mechanical and physical methods : – High energy ball milling – melt quenching and annealing – vapour deposition – Pulsed laser deposition – Magnetron sputtering - Microwave plasma evaporation. Chemical Methods of Preparation : Sol-gel method –Electrodeposition – Electrospinning. Arc method for carbon nanotubes – nanofibres and rods – synthesis of Graphene- Handling of nano particles - Health hazards – Precautions.

MODULE III CHARACTERIZATION OF NANOMATERIALS 8

Characterisation of Nanomaterials: XRD – particle size determination - SEM - FESEM - TEM – AFM – Nanoindentor – UV-VIS spectroscopy – FTIR, FT-Raman, Photoluminescence, NMR, ESR - Dielectric characterization – Magnetic characterization

.

MODULE IV APPLICATION OF NANO MATERIALS 7

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

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

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

1 Nanotechnology: basic science and emerging technologies by Mick Wilson, Kamali Kannangara, Geoff Smith, and Michelle Simmons, Chapman & Hall/CRC; I edition, 2002.

2 Handbook of NanoScience, Engineering and Technology by Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., CRC Press, 2012.

3 Nanocomposite Science and Technology by P. M. Ajayan, L. S. Schadler, P. V. Braun, WILEY-VCH Verlag GmbH, 2003.

4 Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

COURSE OUTCOMES:

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

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

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

CO3:get useful ideas about characterization techniques and differentiatedifferent techniques.

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

Board of Studies (BoS) :
BOS of Physics was held on 21.6.21

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	L	L	L	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 (II SEMESTER)

		L	T	P	C
CHDX01	**CHEMISTRY OF CONSTRUCTION MATERIALS**				
SDG: 9		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

To impart knowledge on

COB1: The chemistry of cement and concrete

COB2: The properties of steel and mechanism of corrosion

COB3: The quality of water and its impact on concrete

COB4: The analytical techniques for concrete research

MODULE I CHEMISTRY OF CEMENT AND CONCRETE 8

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

MODULE II CHEMISTRY OF STEEL AND CORROSION 8

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

MODULE III WATER CHEMISTRY FOR CONCRETE 7

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

MODULE IV ANALYTICAL TECHNIQUES FOR CONCRETE RESEARCH 7

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

L – 30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

1. P.C Jain and Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd.,New Delhi , 2013.
2. S SUmare and S S Dara, A text Book of Engineering Chemistry, S. Chand and Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company,NewYork, 1984.
4. B. Sivasnakar, Engineering Chemistry, Tata McGrow - Hill Publication Limited, New Delhi,second reprint 2008.
5. P. Kumar Mehta and Paulo J.M. Moteiro, "Concrete : Microstructure, Properties and Materials", McGraw Hill Education (India) Pvt. Ltd., 4th Edition, New Delhi, 2014
6. APHA Standard Methods for the Examination of Water & Wastewater, American Public Health Association, USA, 2005.

COURSE OUTCOMES:

CO1: Explain the properties of cement and concrete

CO2: Describe the properties of steel, mechanism of corrosion and its prevention

CO3: Enumerate the impact of water quality on the concrete

CO4: Elaborate the principle, instrumentation and applications of various analytical techniques for concrete research

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

CHDX 02	**CHEMISTRY OF MATERIALS AND ELECTROCHEMICAL DEVICES**	**L**	**T**	**P**	**C**
SDG: 9		**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

The students will be conversant with

COB1:concepts of corrosion, types and various methods to control corrosion.

COB2:the chemicals, chemical reactions, construction and working of different batteries and fuels cells.

COB3:the types, properties and manufacture of refractories and abrasives.

COB4:types, functions of lubricants and mechanism of lubrication.

MODULE I CORROSION AND ITS CONTROL 8

Types of corrosion - chemical corrosion – electrochemical corrosion – galvanic corrosion – differential aeration corrosion - factors influencing rate of corrosion.

Corrosion control – selection of materials - cathodic protection: sacrificial anode - corrosion inhibitors – paints: constituents & functions – treatment of metal surface for inorganic coatings - metallic coatings: hot dipping: galvanizing and tinning – electroplating — electroless plating.

MODULE II ELECTROCHEMICAL DEVICES 8

Electrochemical cell, electrolytic cell - introduction to batteries – classification – primary: dry alkaline – secondary: lead–acid, nickel–cadmium and lithium batteries, Fuel cells – classification based on temperature and electrolyte - hydrogen–oxygen fuel cell, applications – solar cells: construction and working – dye sensitised solar cells.

MODULE III REFRACTORIES AND ABRASIVES 7

Refractories: Introduction - refractory - classification – based on chemical nature - characteristic and selection of good refractory - properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability – general manufacture of refractory – components, properties and uses of: silica, magnesite, zirconia refractories - super refractories - application of refractories.

Abrasives: classification - Moh’s scale – properties - natural abrasives: diamond, corundum, emery, garnet, quartz - synthetic abrasives: preparation, properties and uses: carborundum, alundum, boron carbide (norbide), tungsten carbide, zirconium silicate – grinding wheel – abrasive paper and cloth - Rockwell scale test - knoop hardness test.

MODULE IV LUBRICANTS 7

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

L – 30; Total Hours – 30

TEXT BOOKS:

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

REFERENCES:

1. E. McCafferty, "*Introduction to Corrosion Science*" Springer, May 2010.
2. Tulika Sharma "*Electrochemical devices*" LAP Lambert Academic Publishing, 2011.
3. Jeffry S Gaffney, Nancy A Marley *General chemistry for engineers*, Elsevier, 2018.
4. Don M Pirro, Martin Webster, Ekkehard Daschner "*Lubrication Fundamentals*", Taylor & Francis Gp,LLC, 2016.
5. Theo Mang, Wilfred Dresel "*Lubricants and Lubrication*" Wiley-VCH, 2017

COURSE OUTCOMES:

The students will be able to

CO1:apply specific methods to control corrosion of different materials.

CO2: illustrate the construction and working of different types of cells, batteries and fuel cells.

CO3: compare the properties and devise a method of manufacture of refractories and abrasives.

CO4: analyze and choose the right type of lubrication based on the type of machines.

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

Academic Council:
17th AC held on 15.07.2021

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

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

SDG 9: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

CHDX 03	**CHEMISTRY AND**	**L**	**T**	**P**	**C**
SDG: 9	**STRUMENTATION FOR ELECTRICAL AND ELECTRONIC APPLICATIONS**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

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

COB2: Classification and types of fuel cells.

COB3: Types of sensors and their applications.

COB4: Principle, instrumentation and applications of analytical techniques.

MODULE I ELECTRICAL AND ELECTRONIC DEVICES 7

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

MODULE II FUEL CELLS 7

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

MODULE III SENSORS 7

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

MODULE IV ANALYTICAL TECHNIQUES 9

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

L –30; Total Hours –30

TEXT BOOKS:

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

REFERENCES:

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

COURSE OUTCOMES:

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

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

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

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

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

Academic Council: 17th AC held on 15.07.2021

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

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

CHDX 04	FUNCTIONAL MATERIALS AND APPLICATIONS	L	T	P	C
SDG: 11 & 12		2	0	0	2

COURSE OBJECTIVES:

To make the students conversant with

COB1: specific materials for hardware components fabrication, data storage and their related properties

COB2: selection of advanced materials for various current applications

COB3: materials for the fabrication of sensors

COB4: essential characterization techniques and software tools with chemistry background

MODULE I MATERIALS FOR HARDWARE AND DATA STORAGE 7

Specific materials for electrical and electronic gadgets-computers, instruments (Semiconductors-N, S doped Silicon, CdX QDs, metal nano and other applications). Networking of networks and connecting devices - materials used in robotic construction (metal alloys, kevlor, biodegradable smart materials). Data storage and magnetic hard disk and devices-pendrive (flash memory-ferro magnetic and super paramagnetic materials, optical dics). Nanomaterials to enhance the lifetime and storage of CD, DVD and BD (Nano incorporated Polycarbonate, Al and lacquer) - Nanomaterials and small molecules for data storage.

MODULE II ADVANCED MATERIALS AND APPLICATIONS 8

Materials for 3D printing (Nylon, ABS, PLA, Ti, Au and Ag). Solar panels function monitoring-IOT enabled (crystalline Si, organometallics) – Displays and LCD, LEDs and its types-OLEDs (Group III-V materials). RGB analysis -sensing and TV/system screen (QDs and anthocyanins). Semiconductor chemistry for VLSI processing technology (metalloid staircase, Si, Ge, GaAs)-materials for inkjet printable circuit board (nanocarbon based) - Right material for signal speed and right thermal coefficient of expansion - Remote sensing (photodectectors and radiometers). Solder:-Lead based solder - issues and alternative for lead free solder (Conductive inks).

MODULE III MATERIALS FOR FABRICATION OF SENSORS 8

Wireless Sensors – Introduction to sensors (chemo/bio/gas sensors)-Wearable/touch sensors-Components - selection of materials - Device

fabrication and function monitoring - wireless, Smartphone based and IOT enabled-Properties of materials, anti-corrosive, water proof, insulation and lamination. Robotics in surgery, gene coding and molecular modelling. Biochips and DNA microarray chips(fluorescent dyes, glass/nylon).

MODULE IV ANALYTICAL TECHNIQUES AND SOFTWARE SOLUTIONS 7

Characterization tools – UV-Visible (DRS), FT-IR, SEM, TEM, AFM, TG-DTA 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), DOII: 10.5772/intechopen.85991.
4. W-L. Xing, J. Cheng, Frontiers in Biochip Technology, Springer, 2006.
5. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, 3rd Edition, Springer, 2015.

COURSE OUTCOMES:

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

CO2: Application of specific functionalized materials for advanced applications

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

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

Board of Studies (BoS) :
15th BoS of Department of Chemistry held on 15.06.2021

Academic Council:
17th AC held on 15.07.2021

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

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

SDG 11 & 12 :

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

CHDX 05	**CHEMISTRY OF FUELS,**	**L**	**T**	**P**	**C**
SDG: 9	**COMBUSTION AND LUBRICANTS**	**2**	**0**	**0**	**2**

COURSE OBJECTIVES:

The students will be conversant with

COB1:types, composition and process of manufacture of solid, liquid and gaseous fuels.

COB2:determination of calorific value and calculation of GCV and NCV.

COB3:types, concepts of corrosion and different methods for control of corrosion.

COB4:types, functions of lubricants and mechanism of lubrication.

MODULE I FUELS 8

Introduction – classification of fuels – calorific value – characteristics of a good fuel – comparison of solid, liquid and gaseous fuel – solid fuels – coal – ranking of coal – proximate analysis of coal – pulverised coal – metallurgical coke – manufacture of coke (Otto Hoffman) – Liquid fuel – petroleum – refining of petroleum – cracking – fixed bed catalytic cracking - synthetic petrol – Fischer-Tropsch process – biodiesel - Gaseous fuel – CNG – LPG – Biogas – producer gas – water gas

MODULE II COMBUSTION 8

Introduction – calorific value - Calorific value: Gross and net calorific value - Bomb Calorimeter - Gas calorimeter - Definition of combustion – theoretical calculation of calorific values (Dulong's formula) - Gross and net calorific values (problems) - air-fuel ratio - minimum requirement of air for complete combustion of fuels (problems) — Analysis of flue gas - Orsat's gas analysis method

MODULE III CHEMISTRY OF CORROSION 7

Types of corrosion - chemical corrosion – electrochemical corrosion – galvanic corrosion – differential aeration corrosion - factors influencing rate of corrosion.

Corrosion control – selection of materials - cathodic protection: sacrificial anode - corrosion inhibitors – paints: constituents & functions – treatment of metal surface for inorganic coatings - metallic coatings: hot dipping: galvanizing and tinning – electroplating — electroless plating.

MODULE IV LUBRICANTS 7

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

L – 30; Total Hours – 30

TEXT BOOKS:

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

REFERENCES:

1. Stephen R Turns, “An Introduction to Combustion: Concepts and Applications”, McGraw Hill Education, July 2017,
2. Samir Sarkar, “Fuels and Combustion”, University Press, 2009
3. Dipak K Sarkar “Thermal power plant: Design and operations – Chapter-3”, Elsevier, 2015.
4. E. McCafferty, “Introduction to Corrosion Science” Springer, May 2010.
5. Don M Pirro, Martin Webster, Ekkehard Daschner “Lubrication Fundamentals”, Taylor & Francis Gp,LLC, 2016.
6. Theo Mang, Wilfred Dresel “Lubricants and Lubrication” Wiley-VCH, 20172nd Edition, India, 2012. (ISBN 13: 9788131704370)

COURSE OUTCOMES:

The students will be able to

CO1:compare and interpret the different purpose of application, composition, and calorific value of different fuels.

CO2:calculate the minimum amount of air required, GCV and NCV for the combustion of the fuels.

CO3:apply specific methods to control corrosion of different materials.

CO4:analyze and choose the right type of lubrication based on the type of machines.

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

Academic Council:
!7th AC held on 15.07.2021

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

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

SDG 9: Industry, Innovation & Infrastructure

The holistic understanding of the materials used as fuels and lubricants and devices towards sustainable solutions for the advances in mechanical systems.

CHDX06	INSTRUMENTAL METHODS OF POLYMER ANALYSIS	L	T	P	C
SDG4		2	0	0	2

COURSE OBJECTIVES:

To impart knowledge on

COB1: To impart knowledge on spectroscopic analysis of polymers.

COB2: To equip with the knowledge of optical methods and X-ray diffraction methods for understanding the morphology and orientation of molecules

COB3: To develop an understanding on separation of various mixtures by different chromatographic techniques.

COB4: To understand the chemical elemental structure of polymers by NMR and mass spectroscopic technique.

MODULE I ULTRAVIOLET, VISIBLE AND IR SPECTROSCOPY 9

Principle- Instrumentation-Double beam spectrophotometers – single beam spectrophotometers -sources of radiation – Detectors – I operational procedure – qualitative and quantitative analysis – applications in polymer analysis.

Fourier Transform Infrared Spectroscopy -principle- instrumentation – optical materials – sources- detectors – typical spectrophotometers –– calibration and standardization – sample preparation - analysis – interpretation of FTIR spectra-principle of identification and characterization of polymers using IR

MODULE II NMR SPECTROSCOPY 7

Fundamental concepts – chemical shift – spin –spin- coupling. Instrumentation - data acquisition and spectral interpretation. Solid state NMR (magic angle), Applications of NMR and FT NMR in the characterization of polymers

MODULE III CHROMATOGRAPHY AND THERMAL ANALYSIS 7

Thermal analysis: DSC, TG/DTA, TMA, DMA, DETA with examples. gel permeation chromatography (GPC) – High pressure liquid chromatography (HPLC) – Thin layer chromatography (TLC - Gas chromatography (GC) – sample preparation. Chromatographic process and instrumentation – compositional separation and detectors – various types – Analyses. The uses and applications of various chromatographic techniques – pyrolysis gas chromatography.

MODULE IV X-RAY DIFFRACTION & NEWTON SCATTERING 7

Principle & basic concept of absorption of X-rays- monochromatic X-ray sources – X-ray detectors - Instrumentation – Experimental technique -Analysis by X-ray absorption. Absorption apparatus – X-ray diffraction – Diffraction apparatus. Application to polymer analysis.

L – 30; Total Hours – 30

TEXT BOOKS

1. Douglas A. Skoog, F. James Holler, Stanley R. Crouch “Principles of Instrumental Analysis” 7th edition, Publisher Cengage Learning ,2016
2. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, “Introduction to Spectroscopy” 5th edition, Publisher Cengage Learning ,2015
3. Yang, Rui “Analytical methods for polymer characterization” CRC Press, 2018.
4. Joseph D. Menczel, R. Bruce Prime “Thermal analysis of polymers: fundamentals and applications” John Wiley, 2019.

REFERENCES:

1. Galen W. Euring, “Instrumental methods of chemical analysis”, McGraw Hill International editions, New York, 1985.
2. B.J. Hunt & MI Jones Blackie, “Polymer Characterisation”, Academic professional, London, 1997.
3. Hubert Lobo, Jose V.B.Bonilla, “Handbook of Plastic analysis” , Marcel Dekker inc, New York, 2003.
4. RA pethrick & JV Daukins, “Modern techniques for polymer characterization” , John Wiley & sons Chichester, UK, 1999.
5. D. Campbell and R. White, “Polymer characterization”, Chapman & Hall, London 1989.
6. Arza Seidel, “Characterization and Analysis of Polymers”, John wiley and sons, New jersey, 2008.
7. Nicholas P. Cheremisinoff, “Polymer Characterization: Laboratory Techniques and Analysis”, Noyes publications, New jersey, 1996.
8. John M Chalmers, Robert J Meier, “Molecular characterization and analysis of polymers” Elsevier, 2008

COURSE OUTCOMES:

CO1: Gaining knowledge on principles of various instruments
CO2: Understand about various characterization techniques
CO3: Interpretation the polymer by different techniques

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

Academic Council:
!7th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	L	-	-	-	-	-	-	-	-	M	-	-
CO 2	-	-	-	M	-	-	-	-	-	-	-	-	M	-	-
CO 3	-	-	-	-	-	-	M	-	-	-	-	-	L	-	-
CO 4	-	-	-	M	-	-	-	-	-	-	-	-	L	-	-

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

SDG 4 : Aims at ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all

This course will provide deep knowledge on analysis of polymers using different instrumental methods.

CHDX 07	MEDICINAL CHEMISTRY	L	T	P	C
SDG: 9		2	0	0	2

COURSE OBJECTIVES:

To impart knowledge on

COB1: The basic factors governing drug design.

COB2: The software tools for molecular docking.

COB3: The synthetic pathway of antinfective, antineoplastic, cardiovascular and steroidal drugs.

COB4: The mode of action and side effects of synthetic drugs.

MODULE I INTRODUCTION TO DRUG DESIGN 7

Development of new drugs: Procedure followed in drug design – Literature survey - Search for Active Pharmaceutical Ingredient(s) - Molecular modification – Types of pharmaceutical form / mode of administration, Chemical Characterization of Medicinal Drugs - Molecular docking.

MODULE II ANTIINFECTIVE DRUGS 8

Synthesis, mode of action and side effect of Dapsone and Clofazimine (antileprotic) – Isoniazid, Rifampicin, Pyrazinamide and Ethambutol (antitubercular) – Fluconazole and griseofulvin (antifungal) – Chloroquine and Primaquine (antimalarial) - Semisytheticpencillin, Streptomycin, Ciprofloxacin (Antibiotics) - Nevirapine and Zidovudine (Antiviral)

MODULE III ANTINEOPLASTIC AND CARDIOVASCULAR DRUGS 8

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

MODULE IV STEROIDS AND RELATED DRUGS 7

Synthesis, uses and mode of action - (A) Androgens -testosterone (B) Estrogens and progestational agents – progesterone, (C) Adrenocorticoids – prednisolone, dexamethasone, Remdesivir (D) Glucocorticoids – Cortisol (E)Anabolicsteroids - nandrolone, oxandrolone (F) Neurosteroids – allopregnanolone.

L – 30; Total Hours –30

TEXT BOOKS:

1. An Introduction to Drug Design, S. N. Pandeya and J. R.Dimmock, New Age International, 1997.
2. Burgers's Medicinal Chemistry and Drug Discovery, Fifth Edition; M. E.

Wolff, John Wiley and Sons, 1996.
3. The organic chemistry of drug design and drug action, R. B. Silverman and M. W. Holladay, Academic Press, 3rd Edition, 2014.
4. Introduction to medicinal chemistry**:** How Drugs Act and Why, A. Gringuage, Wiley-VCH, 1996.
5. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry; Eleventh Edition; Lippincott Williams & Wilkins, 2004.

REFERENCES:

1. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley, 2nd Edition 2008.

COURSE OUTCOMES:

CO1: Carry out searches to retrieve information relevant to the development of a new drug.

CO2: Describe and justify the role and importance of the various disciplines involved in the different phases of drug discovery and development.

CO3: Explain how synthetic methods are used to make early decisions in the drug discovery and development.

CO4: Elaborate the mode of action and side effect of the drugs.

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

Academic Council: 17th AC held on 15.07.2021

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

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

SDG 9 :Industry, Innovation & Infrastructure

Understanding of drugs preparation and usage in sustainable method reduces unwanted side effects and help to environments.

MATHEMATICS ELECTIVE –III SEMESTER

		L	T	P	C
MADX 01	**TRANSFORMS AND PARTIAL**				
SDG: 4	**DIFFERENTIAL EQUATIONS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To formulate and solve partial differential equations of first, second and higher orders

COB2: To introduce basics and engineering applications of Fourier series

COB3: To develop Fourier transform techniques

COB4: To introduce analytic solutions of PDEs by using Fourier series

COB5: To acquaint with Z -Transform techniques for discrete time systems.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients

MODULE II FOURIER SERIES 9+3

Fourier Series and Dirichlet's conditions - General Fourier series – Even and Odd functions - Half range Fourier series - Parseval's identity - Harmonic Analysis

MODULE III FOURIER TRANSFORMS 9+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity

MODULE IV APPLICATIONS OF FOURIER SERIES 9+3

Applications of Fourier series to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete and point Spectrum and Single pulse

MODULE V Z – TRANSFORM 9+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations -

Solving Difference Equations using Z-Transform

L – 45 ; T - 15; TOTAL HOURS – 60

TEXT BOOKS:

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

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics", 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: form and solve the partial differential equations using different methods

CO2: derive a Fourier series of a given periodic function by evaluating Fourier coefficients

CO3: apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms

CO4: solve partial differential equations by using Fourier series

CO5: solve difference equations using Z-transform

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

MADX02	DISCRETE MATHEMATICS	L	T	P	C
SDG: 9		3	1	0	4

COURSE OBJECTIVES:

COB1: To introduce logical and mathematical ability to deal with abstraction

COB2: To acquaint with the concepts of predicate calculus.

COB3: To introduce the notations and concepts used in set theory

COB4: To apply and use the terms function, domain, codomain, range, image, inverse image and composition

COB5: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, 30th Reprint 2011.
2.Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

REFERENCES:

1. Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.
2.Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.
3. C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: form truth tables and write principal normal forms

CO2: write the negation of a quantified statement involving either one or two quantifiers.

CO3: prove that a proposed statement involving sets is true, or give a counterexample to show that it is false.

CO4: compute the connection between bijective functions and inverses. Be able to find the inverse of an invertible function.

CO5: give intrinsic structure of groups both abstract and specific examples illustrating the mathematical concepts involved.

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

Academic Council:
17th AC held on 15.07.2021

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

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

SDG 9 : Sustainable Industry, innovation and Infrastructure

Learning of various techniques in functions and set theory will lead to knowledge required for applying in Computer Science projects.

MADX03	PROBABLITY AND STATISTICS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To impart knowledge on the basic concepts of probability

COB2: To understand random variables and distribution functions

COB3: To acquaint with joint density function and generating functions

COB4: To introduce sampling techniques and estimation

COB5: To perform hypothesis testing and draw inference

MODULE I BASIC PROBABILITY CONCEPTS 9+3

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

MODULE II RANDOM VARIABLE AND DISTRIBUTION FUNCTIONS 9+3

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

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 9+3

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

MODULE IV SAMPLING AND ESTIMATION 9+3

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

MODULE V THEORY OF INFERENCE 9+3

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

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill New Delhi, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, New Jersey 1999.
3. S.P.Gupta, “Applied Statistics”,Sultan Chand & Sons 2015.

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier 2016
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics”, Sultan Chand and Sons New Delhi 2012
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, New Delhi 2007.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: Do problems on probability, Baye’s theorem and descriptive statistics.

CO2: Evaluate moment generating functions and calculate probabilities using distributions.

CO3: Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables

CO4: Classify random samplings and calculate point and interval estimates

CO5: : Make an informed decision, based on the results of inferential procedures

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

Academic Council: 17th AC held on 15.07.2021

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

MADX 04	RANDOM PROCESSES	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To acquire knowledge of the theory of probability, Baye's theorem and Tchebechev inequality

COB2: To understand random variables and discrete and continuous probability distributions

COB3: To demonstrate the techniques of two dimensional random variables and its distributions

COB4: To introduce the random process, stationary, Markov process and the study of correlation functions

COB5: To study spectral analysis and Weiner-Khinchine theorem

MODULE I PROBABILITY 9+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II RANDOM VARIABLES AND ROBABILITY DISTRIBUTIONS 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 and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 9+3

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities- Autocorrelation function and its properties - Cross Correlation function and its properties.

MODULE V SPECTRAL DENSITY 9+3

Linear system with random inputs – Ergodicity-Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power Density Spectrum

L – 45 ; T - 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, New Delhi, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, New Delhi,2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, John Wiley & Sons, New Jersey 2007.

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,London,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India, 2nd edition, New Delhi, 200

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

CO1:evaluate probability, apply Baye’s theorem and calculate bounds using Tchebechev inequality

CO2:calculate probabilities and expected values for distributions

CO3:calculate probabilities and derive the marginal and conditional distributions of bivariate random variables

CO4:evaluate stationary process, compute correlation functions and related identities

CO5: compute power spectral density functions and apply Weiner-Khinchine theorem

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

Academic Council:
17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	L													
CO2	M	L													
CO3	M	L													
CO4	H	M													
CO5	H	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 techniques in Random Processes will lead to knowledge required for applying in many projects.

MADX05	NUMERICAL METHODS	L	T	P	C
SDG: 4		3	1	0	4

COURSE OBJECTIVES:

COB1: To familiarize with the methods of solving equations numerically

COB2: To introduce interpolation techniques and finite difference concepts

COB3: To acquire knowledge on Numerical differentiation and integration

COB4: To solve ordinary differential equations numerically

COB5: To solve partial differential equations numerically

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 9+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method

MODULE II INTERPOLATION 9+3

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 9+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V BOUNDARY VALUE PROBLEMS FOR PDE 9+3

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional

Laplace equation

L –45 ; T-15; TOTAL HOURS – 60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers,New Delhi, 2007.
2. Gerald C.F., P.O.Wheatley, “Applied Numerical Analysis” , Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, New York, 2006.
2. Jain M.K., S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003
3. Sastry.S.S,”Introductory Methods of Numerical Analysis”,Fifth Edition,PHI Learning Private Ltd., New Delhi, 2012

COURSE OUTCOMES:

At the end of the course students will be able to

CO1: Solve algebraic, transcendental and system of equations by numerical methods

CO2: Apply various interpolation techniques and finite difference concepts

CO3: Carry out numerical differentiation and integration using different methods whenever regular methods are not applicable

CO4: Solve first order ODE using single and multi step methods

CO5: Solve the boundary value problems in PDE by finite differences

Board of Studies (BoS) :
12th BOS of Mathematics and AS department held 23.06.2021

Academic Council:
17th AC held on 15.07.2021

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

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

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

Learning of various methods in numerical analysis will lead to knowledge of applications in Data Science and Computing

HUMANITIES ELECTIVE – I (III SEMESTER)

		L	T	P	C
SSDX 01	**ENGINEERING ECONOMICS AND MANAGEMENT**				
SDG: 4, 8, 9,12		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To present the major concepts and techniques of engineering economic analysis that is needed in the decision making process by providing insights to the basic microeconomic concepts of demand, supply and equilibrium.

COB2: To generate theoretical knowledge and understanding of macroeconomic aggregates such as national income and inflation and the major challenges associated with the measurement of these aggregates.

COB3: To develop analytical and critical thinking skills on money, banking and public finance and use them to judge the appropriateness of economic development and policy options.

COB 4: To introduce the basic concepts of management and planning and highlight the contribution of planning to the attainment of organization's objectives.

COB 5: To apprise the students about important management concepts and create awareness about the corporate social responsibilities and ethical aspects.

MODULE I DEMAND AND SUPPLY ANALYSIS 9

Introduction to Engineering Economics – Engineering efficiency – Economic efficiency - Scope of Engineering Economics, Engineers' contributions to economic growth- Problem solving and decision making - Laws of Demand and Supply - Difference between Microeconomics and Macroeconomics - Equilibrium between Demand and Supply, Elasticity of Demand - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 8

Concepts of National Income and measurement – GDP Growth Rate - Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – Meaning of Inflation, its types causes and preventive measures.

MODULE III MONEY, BANKING AND PUBLIC FINANCE 10

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary Policy – meaning, objectives, Methods of Credit

Control By RBI, Government Budget – Government revenue and expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) – Economic Reforms in India – LPG Policy.

MODULE IV PRINCIPLES OF MANAGEMENT AND PLANNING 8

Nature of management and its process - Importance of Management-Functions and Principles of Management - Nature, Purpose and Kinds of Planning.

MODULE V ENGINEERING MANAGEMENT 10

Strategic Management-Manager and Environment - Globalization and Technology Intermediation, Corporate Social Responsibility of business - meaning, importance, arguments for and against Corporate Social Responsibility - Business Ethics- Role of Ethics in Engineering Practice-meaning, importance - State intervention in business - Pros and Cons of intervention.

L – 45 ; Total Hours – 45

TEXT BOOKS:

1. Krugman, P, Wells, R, and Graddy, K., “Essentials of Economics”, Worth Publishers, 4th Edition, New York, 2016.
2. Hussain, Moon Moon, “Economics for Engineers”, Himalaya Publishing House, 1st Edition, New Delhi, India, 2015.

REFERENCES:

1. Andrew Gillespie, “Foundations of Economics”, OUP Oxford, England, 2007.
2. Acemoglu, D., Laibson, D., & List, J., “Microeconomics”, Pearson Education, 2nd Edition, Boston, 2017.
3. Brinkman John , “Unlocking the Business Environment”, Routledge, 1st Edition, London, United Kingdom, 2010.(ISBN 9780340942079)
4. Cleaver Tony, “Economics: The Basics”, Routledge, 3rd Edition, London, United Kingdom, 2014.
5. H. L. Ahuja, “Macroeconomics”, S Chand Publishing; Twenty Edition, New Delhi, India, 2019.
6. Koutsoyiannis A, “Modern Microeconomics”, Palgrave Macmillan, 2nd Edition, U.K, 2003.
7. R.A. Musgrave and P.B. Musgrave, “Public Finance in Theory and Practice” , McGraw Hill Education India, Fifth Edition, India, 2017.

8. Mell Andrew and Walker Oliver, “The Rough Guide to Economics”, Rough Guide Ltd, 1st Edition, London, 2014.
9. R. Paneerselvam, “Engineering Economics”, PHI Publication, 2nd Edition, New Delhi, India, 2014.
10. Robbins S.P. Decenzo David A and Coulter, “Fundamentals of Management: Essential Concepts and Applications”, Pearson Education, 9th Edition, London, England, 2014.

COURSE OUTCOMES:

On successful completion of this course, students will be able to

CO1: interpret the forces driving demand and supply and their impact on market conditions.

CO2: demonstrate various dimensions of macroeconomic variables like national income, money supply, employment, etc. in analyzing the effects on business.

CO3: explicate the different aspect of Governmental activities and their rationality and describe how they can be pursued through fiscal and monetary policy.

CO4: develop skills to plan, organize, direct and control the resources of the organization for obtaining common objectives or goals.

CO5: augment managerial skills and adopt ethical practices in various functional areas and engineering practices.

Board of Studies (BOS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on 24.02.2022

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

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

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

SDG 8: Promote sustained, inclusive and sustainable economic growth, full

and productive employment, and decent work for all.

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

SDG 12: Ensure sustainable consumption and production patterns.

Inclusive and equitable quality education can make a critical difference to production patterns, consumer understanding of more sustainably produced goods, promote inclusive and sustainable economic growth along with productive employment and decent work for all.

SSDX 02	**SOCIOLOGY OF SCIENCE AND TECHNOLOGY**	**L**	**T**	**P**	**C**
SDG: 17		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To recognize and define the basic concepts of society and the ways in which sociologists use these concepts in constructing explanations for individual and group problems.

COB2: To illustrate the convergence and divergence of sociology with engineering subjects in terms of the subject matter, nature and scope of the discipline and its approach.

COB3: To demonstrate the relationship between science, technology and society.

COB4: To understand the issues relating to science, technology and change in India both in the historical and globalization contexts.

COB5: To appraise the impact of science and technology on different socio-cultural institutions and processes.

MODULE I INTRODUCTION 8

Sociology - Definition, scope and importance, relationship with other social sciences - Major theoretical perspectives: Functionalism, Conflict Theorizing and Interactionism - Elements of social formation - Society, Community, Groups and Association - Institutions, family and kinship, religion, education, politics - Social process - Associative Social Process - Co-operation, Accommodation and Assimilation - Dissociative Social Process - Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 9

Culture - characteristics, functions, types, cultural lag and civilization - Socialization – process, stages, agencies and anticipatory socialization - Social Control - characteristics, importance, types and agencies - Social stratification. - Meaning, forms - caste and class.

MODULE III SCIENCE, TECHNOLOGY AND SOCIETY 9

Relationship between society and science and vice-versa - Science as a social system - Norms of science - Relationship between science and technology - History of modern science in India – colonial–independence and post-independence science - Science education in contemporary India – primary level to research level - Performance of universities in the development of technology - Interrelationship between industry and

universities.

MODULE IV SCIENCE, TECHNOLOGY AND SOCIAL ISSUES 10

Technology, media, identity and global society - Conformity and deviance and role of science and technology - Technology and development issue - S&T and sustainable development -Role of science and technology in the creation of environmental crisis - Social inequality, social exclusion and digital divide - Science, technology and ethical issues -Gender and technology.

MODULE V GLOBALIZATION, SCIENCE, TECHNOLOGY AND CHANGE 9

Social Change - nature, direction, forms - Technology and rate of social change – Globalization - characteristics, historical and social context- Social consequences of science and technology on civil society - Globalization - Liberalization - Their impact on Indian science and technology - WTO and issues related to intellectual property rights - MNCs and Indian industry.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Giddens A. “Sociology” Wiley India Pvt. Ltd2017
2. Heald Haralambos, R.M “Sociology Themes and Perspectives”, Oxford, New Delhi-92. 2014
3. Sergio Sismondo. An Introduction to Science and Technology Studies Malden: Wiley Blackwell.2010
4. R.K. Merton, Sociology of Science, Theoretical and Empirical Investigations, University of Chicago Press, 1973.

REFERENCES:

1. Atal Yogesh, “Changing Indian Society” Rawat Publications, Jaipur, 2006.
2. Bilton, T. et al “Introductory Sociology”, Palgrave, New York. 2002
3. Das Gupta, Samir and ‘‘An Introduction to Sociology”, Pearson, Delhi. 2012.
4. Francis Abraham M. “Contemporary Sociology: An Introduction to Concepts and Theories”**,** New Delhi, Oxford University Press. 2014
5. Inkless, A, “What is Sociology”, Prentice Hall, New Delhi. 1987
6. Tumin, Melvin M “Social Stratification”, Prentice Hall, New Delhi. 1969.

COURSE OUTCOMES:

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

CO1: recognize the fundamental tenets of Sociology.

CO2: interpret the relationship between individual and society in a sociological perspective.

CO3: categorize and constructively identify their own assumptions about the relationships among society, science and technology

CO4: appraise the dynamics of human society with special reference to the science, technology and contemporary trends of globalization.

CO5: able to link and reflect on current and ongoing sociological debates on development and role of technology.

Board of Studies (BOS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on 24.02.2022

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

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

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

To inculcate knowledge and socialize youth in building participation, institutions and partnership for inclusive development for the implementation of sustainable development goals.

SSDX 03	**INDUSTRIAL ECONOMICS AND MANAGEMENT**	**L**	**T**	**P**	**C**
SDG: 8 and 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To provide a wholesome idea about the concept of industrial economics and identify the classifications of firms based on ownership and control.

COB2: To impart theoretical and analytical knowledge on the different market structures, pricing practices and government policies.

COB3: To equip the students with the framework that will be useful for applying economic models in business strategy, competition policy and regulations.

COB4: To understand the importance of Industrial Policy in the development of Industries in India.

COB5: To elucidate industrial growth in India by examining its performance and problems in industrial sector.

MODULE I INTRODUCTION TO INDUSTRIAL ECONOMICS 9

Definition and scope of industrial economics - Concept and importance of industry; Concept and organization of a firm - Classification of firms based on ownership - sector (industries, formal vs. Informal) - size and use - based classification - Separation of ownership and control - Localization of industries .

MODULE II MARKET STRUCTURE 9

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot Kinked Demand and Price Leadership – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing.

MODULE III PRODUCTION ECONOMICS AND THEORY OF FIRM 9

Production and Production function – Types, Factor Inputs – Input-Output Analysis**,** Undifferentiated Products - Cournot, Stackelberg, Dominant firm model, Bertrand-Heterogeneous products - Chamberlin's small and large number case - Kinked demand curve theory - Bain's limit pricing – Production Possibility Frontier.

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
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on
24.02.2022

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

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

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

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

A comprehensive and holistic approach towards the way for sustainable development and economic growth through the inclusive economic strategy and thereby to reduce the poverty, hunger among people by familiarizing them industry and its importance as survival strategy for earning decent standard of living.

SSDX 04	DYNAMICS OF INDIAN SOCIAL STRUCTURE	L	T	P	C
SDG: 10, 16		3	0	0	3

COURSE OBJECTIVES:

COB1: To provide knowledge on the components of the Indian social structure.

COB2: To learn the nature and contemporary structure of Indian social institutions.

COB3: To sensitize students about social stratification in Indian Society.

COB4: To create awareness about the social problems occurring in contemporary India.

COB5: To explicate the changing institutions, the processes, the agents and the interventions that brings about change in the Indian society.

MODULE I INDIAN SOCIAL STRUCTURE 9

Demographic composition - Racial, religious, ethnic and linguistic -Types of communities - rural, urban, agrarian and tribal - Social backwardness - OBC, SC, ST and EWS - Indian minorities- religious, ethnic, linguistic and LGBT.

MODULE II INDIAN SOCIAL INSTITUTIONS 9

Family - types, characteristics, functions of family - Joint Family- definition features, functions of joint family , dysfunctions of joint family, disintegration of joint family – Marriage - definition, characteristics, marriage as sacrament or contract.

MODULE IIISOCIAL STRATIFICATION IN INDIA 9

Social stratification - Concept of hierarchy - inequality, meaning and characteristics - Social Stratification and Social Mobility - Functions of Social Stratification - Caste, definition, principles, contemporary changes, dominant caste - Caste - class interface - Religious minorities.

MODULE IV SOCIAL PATHOLOGY 9

Social Problem - nature, social disorganization - Population explosion- causes, effects, relationship with development - Child Labour- causes, magnitude and consequences – Unemployment - nature, types, causes and effects - Gender issues - social status of women, violence against women and women in work place - Contemporary issues - communalism, terrorism and corruption.

MODULE V SOCIAL CHANGE IN INDIA 9

Socio-cultural change - Sanskritization – Westernization - Secularization, Modernization - Processes of Social change - Industrialization – Urbanization – Globalization - Social movement - concept, characteristics, functions - New social movement-Women and Environment movement.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Sharma,K.L., “Indian Social Structure and Change”, Jaipur: Rawat Publications, 2008.
2. Ahuja Ram., “Social Problems in India”, Rawat Publication: New Delhi, 2014.
3. Ahuja Ram., “Society in India”, Rawat Publication: New Delhi, 2014.

REFERENCES:

1. Atal Yogesh, “Changing Indian Society” Rawat Publications, Jaipur, 2006.
2. Dube S.C., “India's Changing Villages: Human Factors in Community Development”, London, Routledge and Kegan Paul, 2003.
3. Hasnain N., “Indian Society: Themes and Social Issues”, Mc Graw Hill, 2019.
4. Jayapalan, N., **“**Indian Society and Social Institutions” Atlantic Publishers, 2001.
5. Pandey Vinita., “Indian Society and Culture”, Rawat Publications, New Delhi, 2016
6. Rao Sankar., “Sociology of Indian Society”, S. Chand Publisher, New Delhi, 2004.

COURSE OUTCOMES:

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

CO1: explain about the social structure and social institutions that constitute society in India.

CO2: differentiate the various categories of inequalities and their challenges.

CO3: describe the social stratification and its impact in society.

CO4: analyze the social problems encountered in contemporary India.

CO5: correlate the various forms and trends of the social change in Indian society and realize the relevance of their role in bringing about development.

Board of Studies (BoS) :
5thBoS of SSSH held on 29.12.2021

Academic Council:
18th Academic council held on 24.02.2022

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

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

SDG 10: Reduce inequality within and among countries.
SDG16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

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

Humanities Elective – II
(To be offered in VI Semester)

SSDX 11	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

SDG: 1-17

COURSE OBJECTIVES:

COB1: To inculcate the knowledge base on sustainable development with a view to balance our economic, environmental and social needs, allowing prosperity for now and future generations.

COB2: To develop a capacity to undertake a theoretically grounded analysis of environment issues and identify and describe what the United Nations and other governing bodies are doing to assist in a more sustainable world.

COB3: To have an insight of the emerging debate about reconciling ecological sustainability with poverty alleviation in the context of globalization and development.

COB4: To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 8

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components – Sustainable Development Goals – Quality education, Gender equality, innovation and infrastructure, peace and justice - Sustainable engineering practices.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 6

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.

International responses to environmental challenges - Global policy such as Kyoto Protocol, Paris Agreement, Montreal Protocol, Basel Convention.

Community Participation in Sustainable Development, Common Property Resource Management, Innovation, Industry and Sustainable Development.

MODULE III GLOBALIZATION AND ENVIRONMENT 7

SUSTAINABILITY

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability - Globalization and Global Governance.

Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT **9**

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.

Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L –30 ; TOTAL HOURS – 30

TEXT BOOKS:

1. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, “An Introduction to Sustainable Development”, Glen Educational Foundation, 1st Edition, England, UK, 2008.

2. Sayer, J. and Campbell, B, “The Science of Sustainable Development: Local Livelihoods and the Global Environment” (Biological Conservation, Restoration &Sustainability), Cambridge University Press, London, 2003.

REFERENCES:

1. Anderson, David A, “Environmental Economics and Natural Resource Management”, Routledge, 3rd edition, England, UK, 2010.
2. Berck, P., “The Economics of the Environment”, New Delhi: Pearson India, 2015.
3. Karpagam M, “Environmental Economics: A Textbook.pdf”, Sterling Publishers Pvt. Ltd, New Delhi, 2021.
4. Kumar, Pushpam, “Economics of the Environment and Development”,Ane Book Publication, New Delhi, India, 2009.
5. Karpagam M and Jaikumar Geetha, “Green Management Theory and Applications”, Ane Books Pvt. Ltd, New Delhi, India, 2010.
6. Sengupta Ramprasad, “Ecology and Economics: An Approach to Sustainable Development”, Oxford University Press, New Delhi, 2004.

7. Muthukrishna, S, “Economics of Environment”, PHI Learning Pvt. Ltd., New Delhi, India, 2010.

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

CO1: Develop awareness of the ethical, economic, social and political dimensions that influence sustainable development.

CO2: Clearly articulate their views and beliefs with regards to environmental issues.

CO3: Identify and describe the major economic forces that shape our approach to the environment issues and demonstrate responsible globalization through global governance.

CO4: Account for strategies, international agreements and major policy instruments for a sustainable use of resources and ecosystem services.

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

Academic Council: 17th AC held on 15.07.2021

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

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

SDG 1: End poverty in all forms and everywhere.

SDG 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

SDG 3: Ensure healthy lives and promote well-being for all at all ages

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

SDG 5: Achieve gender equality and empower all women and girls

SDG 6: Ensure availability and sustainable management of water and sanitation for all.

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.

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

SDG 9: Build resilient infrastructure, promote inclusive and sustainable

industrialization, and foster innovation
SDG 10: Reduce income inequality within and among countries
SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable.
SDG 12: Ensure sustainable consumption and production patterns
SDG 13: Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
SDG 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The holistic understanding of all the 17 SDGs aims to end poverty, ensure prosperity, and protect the planet.

SSDX 12	SOCIOLOGY OF INDUSTRIAL RELATION	L	T	P	C
		2	0	0	2

SDG: 8, 9

COURSE OBJECTIVES:

COB1: To familiarize sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.

COB2: To highlight the structure and functions of industrial organizations

COB3: To explicate the dynamics of organizational behavior, leadership and communication.

COB4: To provide an overview in labour legislation and labour welfare

MODULE I INTRODUCTION 7

Sociology of Industrial relation - definition, scope and importance - Theoretical approaches- scientific management, human relations approach, theory of bureaucracy- Fordism and post-fordism - Production system-concept and characteristics of factory system - automation and rationalization -The Industrial Employment (Standing Orders) Act, 1946 Industrial conflict-strike, lockout and trade unions- Emerging role of trade unions in India.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility - Informal organization-definition, characteristics, types and relevance - Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction- Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 7

Group dynamics- Definition, Group behaviour model - Group decision making process, group cohesiveness - Leadership- definitions, style and effective supervision- Communication- concepts, types, model barriers - Job satisfaction- nature, employee compensation and job satisfaction. Grievance Handling and Disciplinary Action, Code of Conduct, Industrial Relations in changing scenario, Employers' organisations.

MODULE IV LABOUR LEGISLATION AND LABOUR WELFARE 9

Labour Legislation-Objectives, Principles, Classification and Evolution. International Labour Organisation. Social Justice and Labour Legislation, Indian Constitution and Labour Laws- The Factories Act, 1948, The Inter-state Migrant Workmen Act, 1979, The Contract Labour (Regulation and Abolition) Act, 1970, The Child Labour (Prohibition and Regulation) Act, 1986. Labour welfare-Concept, Scope, Types, and Principles, Industrial Health and Hygiene, Industrial Accidents and safety, Occupational Diseases. Social Security-Concept and Scope, Social Assistance and Social assurance.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Mamoria ,Gankar., “Dynamics of Industrial relations”, Himalaya Publishing House,Mumbai, 2007.
2. Narender Singh ., “Industrial Sociology”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
   Kumar., “Industrial Sociology”, Lakshmi Narain Agrawal Publishers, Agra, 2019.
3. SharmisthaBhattacharjee, “Industrial Sociology”, Aavishkar Publishers, Jaipur, 2016.

REFERENCES:

1. Bhatnagar M., “Industrial Sociology”,S. Chand Publications, New Delhi, 2012.
2. MisraRajan., “Industrial Sociology”, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.), New Delhi, 2013.
3. Newstorm W John, “Organizational Behavior”, Mc. Graw Hill Publishing Co., New Delhi, 2006.
4. Nina, Bandlej (ed)., “Economic Sociology of Work”, Bingley: Emerald Group Publishing Ltd, 2009.
5. Richard Brown, John Child, S.R. Parker, “The Sociology of Industry”, Routledge Publisher, 2015.
6. Sushil Kumar Saxena, Satish Mittal, “Industrial Sociology”,Common Wealth Publishers, 2012.
7. Watson, Tony, “Sociology, Work and Industry (5th edition), Oxon: Routledge, 2008.

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

CO1: Understand the sociological perspectives for dealing with social relationships in production and service organizations.

CO2: Have deeper knowledge in structure of authority, roles and responsibility in organizational settings.

CO3: Assess the role of leadership, communication and behavioral acumen to govern the organization.

CO4: Describe the importance of labour legislation and labour welfare

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

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

The holistic understanding of industrial relations leads to equal access to opportunity, and equal pay for work of equal value for male and female contributions is necessary for gender equality as well as for inclusive economic growth. Explore work opportunities, understand career processes and appreciate the meaning and purpose of work in people's lives which leads to decent work and safe working practices.

SSDX 13	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C
		2	0	0	2

SDG: 8

COURSE OBJECTIVES:

COB1: To render basic insights and inputs to the students to inculcate human values to grow as responsible human beings with a proper personality.

COB2: To create awareness on senses of engineering ethics.

COB3: To inculcate knowledge and exposure on safety and risk, risks benefit analysis and professional rights.

COB4: To instill social values and loyalty and to appreciate the rights of others.

MODULE I HUMAN VALUES 7

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

MODULE II ENGINEERING ETHICS 7

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - Theories about right action - Self-interest - Customs and Religion - Uses of ethical theories - Valuing Time – Co-operation – Commitment.

MODULE III SAFETY, RESPONSIBILITIES AND RIGHTS 8

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

MODULE IV CONTEMPORARY ISSUES 8

Globalisation-Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Ethics-Ethics and codes of business conduct in MNC.

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Govindarajan M, Natarajan S, Senthil Kumar V. S., “Engineering Ethics”, Prentice Hall of India, New Delhi, 2019.
2. Kiran. D R, “Professional Ethics and Human Values”, Mc Graw Hill Publishers,New Delhi, 2013.
3. Naagarazan R.S., “Professional Ethics and Human Values”, New Age International Publishers, New Delhi, 2006.
4. R Sangal, RR Gaur and G P Bagaria, “Foundational Course in Human Values & Professional Ethics”, Excel Books, India, 2010.

REFERENCES:

1. Charles D. Fleddermann , “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S.Protchard and Michael J Rabins., “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000.
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
6. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York, 2010.
7. Subramanian. R,“Professional Ethics - Includes Human Values”, Oxford HED Publishers, 2017.\

COURSE OUTCOMES:

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

CO1: Apply moral and ethical values scrupulously that ought to guide the engineering profession.

CO2: Understand the ethical issues related to engineering aspects.

CO3: Assess safety and risk and execute risk benefit analysis.

CO4: Become responsible engineers, experimenters, researchers or businessmen

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

Academic Council:
17th AC held on 15.07.2021

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

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

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

Holistic understanding of professional ethics explores work opportunities, understand career processes and appreciate the meaning and purpose of work in people's lives leading to a decent work and safe working practices and environments.

SSDX 14	GENDER, TECHNOLOGY AND DEVELOPMENT	L	T	P	C
		2	0	0	2

SDG: 8

COURSE OBJECTIVES:

COB1: To conceptualize what is gender and sex and draw a line of distinction between the two.

COB2: To develop students' sensibility to the difference in gender roles, responsibilities, rights and injustice.

COB3: To reflect critically on the ways in which new technologies have sharpened and/or blurred gender difference.

COB4: To develop an insight to the gender and development with the paradigm shift from time to time.

MODULE I UNDERSTANDING GENDER 7

Basic Concepts: Sex/Gender, Gender roles, Gender socialization, - Construction of Gender- Making Women, Making Men Gender stereotyping, Femininity and Masculinity, Patriarchy, Heteronormativity, LGBTIQ - Theoretical Background to gender and feminist thinking: Liberal, Radical, Marxist, Socialist, Post-modern Feminism.

MODULE II GENDER ROLES AND GENDER INJUSTICE 7

Gender Roles and Relations-Types of Gender Roles Gender Roles and Relationships Matrix. Health conditions, Sex Ratio, Education: Literacy & Gender Bias - Work Related Issues: Existing Prejudices, gender Related Violence, Gender Discrimination - Political participation: Lack of women's representation - Economic Conditions- Social Conditions: divorce, rape, domestic violence.

MODULE III GENDER, TECHNOLOGY AND CHANGE 8

A historical perspective – Technology as masculine culture – Household technology – medical technology: New Reproductive technologies – Impact of Technological Change on Women. The Digital Divide: Unequal Access, Unequal Effects – Outcome and impact of ICT's Policies and projects for women. How gender influences technologies and the social organization of scientific and technical workspaces.

MODULE IV GENDER AND DEVELOPMENT 8

Gender, Governance and Sustainable Development - Women's role in Development - Women in Development (WID), Women and Development

(WAD) - Gender and Development (GAD); Gender Mainstreaming and Gender Budgeting - Gender and Human Rights

L – 30; TOTAL HOURS –30

TEXT BOOKS:

1. Bhasin, Kamala., "Understanding Gender", New Delhi: Kali for Women, 2000.
2. John, Mary E., "Gender and Development in India, 1970-90's: Some reflections on the constitutive role of context' Chaudhuri, Maitrayee. (ed.) Feminism in India", New Delhi: Kali for women. pp. 246-258, 2004.
3. Menon, Nivedita, "Embodying the Self: Feminism, Sexual Violence and the Law" in Partha Chatterjee and Pradeep Jeganathan (ed)- Subaltern Studies XI: Community, Gender and Violence", Permanent Black and Ravi Dayal, 2000.
4. Gender and Technology: A reader ., Edited by Nina E. Lerman, Ruth Oldenziel, and Arwen P. Mohun, John Hopkins University Press, Baltimore , 2003.

REFERENCES:

1. Lourdes Beneria , GünseliBerik , Maria Floro .,"Gender, Development and Globalization: Economics as if All People Mattered", 2nd edition , Routledge, 2015.
2. Moser, Caroline, "Gender Planning and Development: Theory, Practice and Training", Routledge, 1993.
3. Rege, Sharmila., "Sociology of Gender: The Challenge of Feminist Sociological Knowledge", Sage publications: New Delhi, 2003.
4. Jain S.C., Women and Technology, Rawat Publication, Jaipur Begh, 1985.

COURSE OUTCOMES:

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

CO1: Distinguish important concepts related to gender in contemporary society.

CO2: Interpret the gender discrimination works in our society and how to counter it.

CO3: Illustrate how the intersection of gender and technology involves gender shaping technology and technology shaping gender.

CO4: Apply gender sensitive perspective on development and human rights.

Board of Studies (BoS) : 4th BoS of SSSH held on

Academic Council: 17th AC held on 15.07.2021

28.06.2021

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

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

SDG 5: Achieve gender equality and empower all women and girls

To imbibe gender concern and gender perspective in the invention, and application of technology, planning and designing production and innovating strategies for engendering gender equality.