B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2017
Curriculum and Syllabi

(Amendments updated upto June 2020)

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 2017
CURRICULUM AND SYLLABI
(Amendments updated upto June 2020)

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

- To provide students with core competence in mathematics, science and engineering concepts essential to formulate, analyze and solve hardware / software engineering problems.

- 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.

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

- 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.

- 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

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

- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

- 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.

- 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.

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

- 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.

- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- 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.

- 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.

- 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.

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

- To focus on need based research in different domains relevant to Information Technology and carry out research projects of national and social relevance.

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

- To develop communication, problem solving, team spirit and leadership skills for a successful professional career.

REGULATIONS - 2017
B.TECH. DEGREE PROGRAMMES
(With Amendments incorporated upto June 2020)
(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

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

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

iii) **"Course"** means theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in asemester like Mathematics, Physics, Engineering Graphics, Fluid Mechanics, etc.,

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

v) **"Dean (Academic Affairs)"**means the Dean (Academic Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.

vi) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.

vii) **"Controller of Examinations"** means the Controller of Examination ofB.S.Abdur Rahman Crescent Institute of Science and Technologywho is responsible for conduct of examinations and declaration of results.

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) Candidates for admission to the third semester of the eight-semester B.Tech.programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamil Nadu or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.2 Notwithstanding the qualifying examination the candidate might have passed, 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 Mathematics, Physics and Chemistry on the standards prescribed for Ten plus Two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution 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.

B.TECH. DEGREE PROGRAMMES:

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

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 Sciences (BS)
ii) Humanities & Social Sciences (HS)
iii) Management Sciences (MS)
iv) Engineering Sciences Fundamentals (ESF)
v) Engineering Core Courses (EC)
vi) Professional Electives (PE)
vii) General Electives (GE)
viii) Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

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
- 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., of total number of credits not exceeding 26.

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the respective programme of study.

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 ordinarily 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 student).

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

5.3 Semester end examination shall normally follow within a week after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

A faculty member shall be nominated by the HoD 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.

6.2 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.

7.0COURSE COMMITTEE

7.1 Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

8.0 CLASS COMMITTEE

A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman is constituted branch wise and semester wise

8.1 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.

8.2 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) Faculty members of all 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

8.3 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 nature 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.

8.4 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.

8.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze 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 concerned course coordinator.

9.0 REGISTRATION AND ENROLLMENT

9.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.2 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.

10.0 COURSE CHANGE / WITHDRAWAL

10.1 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.

10.2 WITHDRAWAL FROM A COURSE

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

11.0 TEMPORARY BREAK OF STUDY FROM PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first continuous assessment testof the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 5.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it shall not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only.

12.0 CREDIT LIMIT FOR ENROLLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 32 credits during a semester including Redo / Pre-do Courses.

12.2 The minimum earned credit required to move to the higher semester shall be

- Not less than 20 credits, to move to the 3rd semester
- Not less than 40 credits, (20 for lateral entry) to move to the 5th semester
- Not less than 60 credits, (40 for lateral entry) to move to the 7th semester

13.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

13.1 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%

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

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

13.4 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 component 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 component shall be through continuous assessment.

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

13.6 In the case of Industrial training, 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 organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

13.7 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations. 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.

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

13.9 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 be ignored.

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 component.

14.0 SUBSTITUTE EXAMINATIONS

14.1 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 School for that purpose. However, there is no substitute examination for semester end examination.

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

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

15.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the in approved events etc.) 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. The cases in which the student is awarded "I" grade, shall register and repeat the course when it is offered next.

15.2 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 that course to the Class Advisor. The Class Advisor shall consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department/ Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

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

15.4 A student should register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" 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 Head of the Department / Dean of School.

15.5 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 in the evening when the course is offered by the department. Marks scored in the continuous assessment during the redo classes shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtained "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.

15.6 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.

16.0 REDO COURSES

16.1 A student can register for a maximum of two redo courses per semester in the evening after regular college hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters.

16.2 The Head of the Department with the approval of Dean Academic Affairs may arrange for the conduct of a few courses during the evening, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

16.3 The number of contact hours and the assessment procedure for any redo course shall be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

17.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. 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	0
I	0
AB	0

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

17.2 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.

17.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of the School and it shall be declared by the Controller of Examinations.

17.4 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 Controller of Examination. Subsequently the Head of the Department/ Dean of 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 member of faculty knowledgeable in that course. 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.

17.5 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 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 Ci, is the number of credits assigned for the i^{th} course and GPi 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”, "AB" 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

17.6 After successful completion of the programme, the Degree shall be awarded 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 semester for normal entry and 6 semesters for lateral entry
First Class	6.50 and above and completing the programme within a maximum of 10 semester for normal entry and 8 semesters for lateral entry
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained 'U' or 'I' grade in any course during his/her study and should have completed the U.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study. For this purpose, the authorized break of study is not counted. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE:

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 ONLINE / SELF STUDY COURSES

Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

19.0 SUPPLEMENTARY EXAMINATION

Students of final year 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 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 both Odd and Even Semester.

20.0 PERSONALITY AND CHARACTER DEVELOPMENT

20.1 All students shall enroll, on admission, in any of the personality and character development programmes such as NCC, NSS, NSO, YRC, Rotaract, etc., and undergo related activities during the period of study.

21.0 DISCIPLINE

21.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

21.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

22.0 ELIGIBILITY FOR THE AWARD OF DEGREE

22.1 A student shall be declared to be eligible for the award of B.Tech. degreeprovided the student has:

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study

ii) no dues to the Institution, Library, Hostels, etc.

iii) no disciplinary action pending against him/her.

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

23.0 MINOR DEGREES OFFERED FOR STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2020- 21

23.1 The students admitted inthe following B.Tech. Programmes from the academic year 2020 – 21 can graduatewith a minordegree, which is optional, along with a major degree:

• Civil Engineering	• Mechanical Engineering
• Electronicsand Communication Engineering	• Electrical and Electronics Engineering

• Automobile Engineering	• Aeronautical Engineering
• Polymer Engineering	• Biotechnology Engineering
• Electronics and Instrumentation Engineering	• Computer Science and Engineering
• Information Technology	• Artificial Intelligence and Data Science
• Computer Science and Engineering (IoT)	• Computer Science and Engineering(Cyber Security)

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

Sl. No.	Minor Degree (Optional)	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 & Electronics Engg. Electronics & Instrumentation Engg.
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 & Electronics Engineering Electronics & Instrumentation Engg. Electronics & Communication Engg.
7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical & Electronics Engg.
8.	Robotics	Artificial Intelligence and Data Science Computer Science & Engg. (Cyber Security) Computer Science & Engineering (IoT) Computer Science & Engineering Information and Technology

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

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

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

23.4 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.

24.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has theright 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 TECHNLOGY

CURRICULUM& SYLLABI, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1182	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer ProgrammingI (Laboratory)	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II (Laboratory)	1	0	2	2
7.	EC	ITC 1201	Digital Principles and	2	0	2	3

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
			Applications					
8.	EC	ITC1202	Programming in Python	2	0	2	3	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	ITC 2101	DataStructures	3	0	2	4	
5.	EC	ITC 2102	Computer Architecture	3	0	0	3	
6.	EC	ITC 2103	ComputerNetworks	3	0	0	3	
7.	EC	ITC 2104	Advanced Java and Internet Programming	3	0	0	3	
8.	EC	ITC 2106	Network Configuration Laboratory	0	0	3	1	
9.	EC	ITC 2107	Advanced Java and Internet Programming Laboratory	0	0	3	1	**22**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	ITC2212	Database Management System	3	0	0	3
5.	EC	ITC2213	OperatingSystems	3	0	2	4
6.	EC	ITC2214	SoftwareEngineering	3	0	0	3

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
7.	EC	ECC2208	Signals and Systems	3	0	0	3	
8.	EC	ITC2215	DBMS Laboratory	0	0	3	1	
9.	PE		Programme Elective - I				3	**24**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill – I Confidence Building	0	0	2	1	
4.	EC	ITC3101	Object Oriented Analysis andDesign	3	0	0	3	
5.	EC	ITC3102	Fundamentals of Web Designing	2	0	2	3	
6.	EC	ITC3103	Microprocessors and Microcontroller	3	0	2	4	
7.	EC	ITC3104	Case Tools Laboratory	0	0	3	1	
8.	PE	-	Programme Elective – II				6	**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	BS	-	Mathematics Elective II	2	0	0	2	
3.	HS	ENC3281	Communication and soft skill – II Career Choice	0	0	2	1	

4.	EC	ITC3211	SoftwareTesting	3	0	0	3	
5.	EC	ITC3212	Cloud Computing Technologies	3	0	0	3	
6.	EC	ITC3213	Distributed Computing	3	0	0	3	
7.	EC	ITC3214	Open Source Technologies (Laboratory)	1	0	2	2	
8.	EC	ITC3215	Software Development Laboratory	0	0	3	1	
9.	PE	-	Programme Elective - III				6	**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	ITC4101	Internet of Things	3	0	2	4	
3.	EC	ITC4102	InformationSecurity	3	0	0	3	
4.	EC	ITC4103	Wireless Networks	3	0	0	3	
5.	EC	ITC4104	Programming in Hadoop (Laboratory)	0	0	3	1	
6.	PE	-	Programme Elective - IV	0	0	0	9	
7.	EC	ITC4105	Internship				1*	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	ITC4211	Project Work	0	0	24	12	**12**

Total credits – 177

* Industrial training will be undertaken during Third year summer vacation for 15 days. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

IV SEMESTER ELECTIVES (3 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX 201	Android Application Development (Laboratory)	1	0	2	2
2.	PE	ITCX 202	Nextgen Technologies	3	0	0	3
3.	PE	ITCX 203	Multimedia Tools and Techniques (Laboratory)	0	0	3	1
4.	PE	ITCX 204	System Software	3	0	0	3
5.	PE	ITCX 205	Principles of Communication	3	0	0	3
6.	PE	ITCX 206	Principles of Compiler Design	3	0	0	3
7.	PE	ITCX 207	User Interface Design	3	0	0	3
8.	PE	ITCX 208	Semantic Web	2	0	0	2

V SEMESTER ELECTIVES (6 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX 101	iOS Application Development (Laboratory)	1	0	2	2
2.	PE	ITCX 102	Oracle Database Programming (Laboratory)	0	0	3	1
3.	PE	ITCX 103	Natural Language Processing	3	0	0	3
4.	PE	ITCX 104	Game Theory	3	0	0	3
5.	PE	ITCX 105	Soft Computing	3	0	0	3
6.	PE	ITCX 106	Machine Learning Algorithms	3	0	0	3
7.	PE	ITCX 107	C# and .NET Framework	3	0	2	4

8.	PE	ITCX 108	Artificial Intelligence	3	0	0	3
9.	PE	ITCX 109	Grid Computing	3	0	0	3
10.	PE	ITCX 110	Information Coding Techniques	3	0	0	3
11.	PE	ITCX 111	Mobile AdHoc Networks	3	0	0	3
12.	PE	ITCX 113	TCP/IP Protocol Suite	3	0	0	3

VI SEMESTER ELECTIVES (6 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX 212	Hybrid Application Development (Laboratory)	1	0	2	2
2.	PE	ITCX 213	Data MiningTechniques and Tools	2	0	2	3
3.	PE	ITCX 215	Software Requirements Management and Software Project Management	3	0	0	3
4.	PE	ITCX 216	Business and Data Analytics	3	0	0	3
5.	PE	ITCX 217	Web Services	3	0	0	3
6.	PE	ITCX 218	Image Processing	3	0	0	3
7.	PE	ITCX 219	Expert Systems	3	0	0	3
8.	PE	ITCX 220	Service Oriented Architecture	3	0	0	3
9.	PE	ITCX 221	Pervasive Computing	3	0	0	3
10.	PE	ITCX 222	Knowledge Based Decision Support System	3	0	0	3
11.	PE	ITCX 223	Electronics Commerce	3	0	0	3
12.	PE	ITCX 224	Introduction to Industry 4.0 and Industrial IoT	3	0	0	3

VII SEMESTER ELECTIVES (9 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX 117	Cloud Middleware Tools (Laboratory)	1	0	2	2
2.	PE	ITCX 118	Big Data Tools and Technologies (Laboratory)	1	0	2	2
3.	PE	ITCX 119	Forensic Tool Kits (Laboratory)	0	0	3	1
4.	PE	ITCX 120	MongoDB for Java developers (Laboratory)	0	0	3	1
5.	PE	ITCX 121	Green Computing	1	0	0	1
6.	PE	ITCX 122	XML Technologies (Laboratory)	0	0	3	1
7.	PE	ITCX 123	Big Data Analytics	3	0	0	3
8.	PE	ITCX 124	Programming in Scala (Laboratory)	0	0	3	1
9.	PE	ITCX 125	R Programming (Laboratory)	1	0	2	2
10.	PE	ITCX 126	Virtual Reality	2	0	2	3
11.	PE	ITCX 127	Software Quality Management	3	0	0	3
12.	PE	ITCX 128	Cloud Forensics	3	0	0	3
13.	PE	ITCX 129	Networking Simulators (Laboratory)	0	0	3	1
14.	PE	ITCX 130	Enterprise Resource Planning	3	0	0	3
15.	PE	ITCX 132	Artificial Intelligence for Data Science	3	0	0	3
16.	PE	ITCX133	Blockchain Technology	3	0	0	3
17.	PE	ECCX70	Embedded System	3	0	0	3

Physics Elective Courses
(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses
(To be offered in II Semester)

Sl. No.	Course code	Name of the Courses	L	T	P	C
1.	CHCX01	Analytical instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its control	2	0	2	3
3.	CHCX03	Electrical materials and batteries	2	0	2	3
4.	CHCX04	Engineering materials	2	0	2	3
5.	CHCX05	Fuels and combustion	2	0	2	3
6.	CHCX06	Fundamentals of physical chemistry	2	0	2	3
7.	CHCX07	Green technology	2	0	2	3
8.	CHCX08	Organic chemistry of biomolecules	2	0	2	3
9.	CHCX09	Polymer science and technology	2	0	2	3

Maths Elective Courses
(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics and Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses
(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I
(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II
(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective
Group I Courses
(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS

13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses
(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Matlab Simulation	EEE
8.	GECX208	Embedded Systems and its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry

Sl. No.	Course Code	Course Title	Offering Department
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil
19.	GECX 219	Advanced Entreprenuership	MBA
20.	GECX 220	Electric Vehicles	EEE
21.	GECX 221	Artificial Intelligence and Evolutionary Computing using Matlab	EEE

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

Introduce eigen values and eigenvectors of matrix algebra.

Make the student knowledgeable in the area of Three Dimensional Analytical Geometry.

Demonstrate the application of Differential Calculus.

Familiarize the student with the functions of several variables.

Develop the use of ODE solvable techniques necessary for engineering applications.

Motivate the students with some basic engineering application problems in ODE.

MODULE I MATRICES 8+2

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 THREE DIMENSIONAL ANALYTICAL GEOMETRY 7+3

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III DIFFERENTIAL GEOMETRY 7+3

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 8+2

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 8+2

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

MODULE VI APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS 7+3

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills

Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:
Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.

Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:

Family, travel

Market, Prayer hall

Writing skills:

Note making.

Sequencing of sentences.

Developing answers from the questions.

Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.

Reading and writing skills.

Audio & Video aided listening.

Introduction to Arabic terms related to administration.

Situation communication:

Air travel, Office administration, passport, visa.

Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:

Contractual work, machineries and equipments..

Computer, internet browsing.

Banking,

Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings

· Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.
2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, -number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1182	PHYSICS I	L	T	P	C
		3	0	2	4

OBJECTIVES

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS 8

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS 8

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS 8

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism –

Laser Action – Types of Laser: He-Ne laser, CO_2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 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 - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI MODERN ENGINEERING AND BIOMATERIALS 7

Modern Engineering Materials: Shape memory alloys - Metallic glasses – Advanced Ceramics – Composites.

Bio-materials: Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements.

L:45 periods

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.

8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

P: 30 periods
Total: 75 periods

REFERENCES:

1. Gaur R.K. and Gupta S.L., "Engineering Physics'', 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. "Physics for Engineers and Scientists". W.W. Norton & Co. 2007.
6. Godfrey Boyle, "Renewable Energy: Power for sustainable future", 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

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

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181 CHEMISTRY L T P C

3 0 2 4

OBJECTIVES

To make the students conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water and treatment processes involved.
- types of electrodes, determination of pH, emf measurement, conductometric and potentiometric titration.
- the basic analytical techniques like colorimetry, UV-Visible, flame photometry and AAS.
- concepts of photochemistry related to physical processes and chemical reactions induced by photon absorption and their applications.
- the non-renewable sources such as thermal and nuclear energy, importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean with their advantages and limitations.
- the synthesis, properties and applications of nanomaterials.

MODULE I WATER TECHNOLOGY 9

Impurities present in water – hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment :– zeolite process (principle only), ion-exchange process – internal treatment :– colloidal, carbonate, phosphate and calgon methods – drinking water standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration and disinfection} – desalination by reverse osmosis.

MODULE II ELECTROCHEMISTRY 8

Types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode) – pH determination using glass electrode – concentration cells (problems) – standard cell (Weston-cadmium) – EMF measurement (problems) – conductometric titrations – potentiometric titrations.

MODULE III ANALYTICAL TECHNIQUES 7

Spectroscopy: (relation between interaction of electromagnetic radiation withmatter and type of spectroscopy), electromagnetic spectrum – types of transitions – types of spectra (atomic and molecular) – Beer-Lamberts law (problems) – principles,

instrumentation (block diagram only) and applications of: colorimetry (includes estimation of concentration of a solution) – UV-Vis spectrophotometer – atomic absorption spectroscopy – flame photometry (includes estimation of concentration of alkali metal).

MODULE IV PHOTOCHEMISTRY 7

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

MODULE V ENERGY SOURCES 8

Renewable and non-renewable energy: comparison, advantages and limitations – non-renewable energy : thermal energy (principle only) – nuclear reactor (components and functions) – nuclear energy (problems) – renewable energy: needs of renewable energy – solar energy : solar photovoltaic, advantages and limitations – wind energy: wind resources, wind turbines, advantages and limitations – bioenergy: biogas generation, factors affecting biogas generation, biomass gasifier, advantages and limitations – geothermal energy: principle, types of geothermal resources, advantages, limitations and applications – ocean energy: tidal and ocean thermal energy (principle, advantages and limitations).

MODULE VI NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis :– top-down approach: chemical vapour deposition, laser ablation, electrodeposition – bottom-up approach: precipitation, thermolysis (hydrothermal and solvothermal) – properties and applications of nanomaterials.

L:45 periods

PRACTICALS

1. Estimation of hardness in the given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of dissolved oxygen in the given water sample.
4. Determination of EMF of the cell.
5. Estimation of a strong acid by conductometry.
6. Estimation of Fe^{2+} present in the given sample by potentiometry.
7. Verification of Beer-Lamberts law and estimation of metal ion concentration of the given sample.

8. Estimation of sodium and potassium present in the given sample by flame photometry (demonstration).

P:30 periods

Total: 75 periods

REFERENCES

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge,2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- describe the various types of electrodes, determine pH, measure EMF, explain and determine the concentration of acid and ions using conductometric and potentiometric titrations.
- verify and derive Beer-Lambert’s law, state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- describe the various components and functions of nuclear reactor, explain the principle and enumerate the advantages and limitations of various renewable energy sources.
- classify nanomaterials and discuss their properties & applications; and apply nanochemistry approach to synthesize the nanomaterials.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

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

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

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

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

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

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

MODULE VI PICTORIAL PROJECTIONS **10**

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

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

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, ‘Engineering Drawing’ Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, ‘A text book of Engineering Graphics’, Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102 ENGINEERING DESIGN

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L 0	T 0	P 2	C 1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I (LABORATORY)	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS 7

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C 8

Introduction to C Programming Language – Operators - Control statements - Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logicaland bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops– nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd

Edition, ISBN 13: 9788131704370, 2012

2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – 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 VI COMPLEX INTEGRATION 7+3

Statement and application of 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).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
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.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.
- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211 BASIC ENGINEERING MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 07

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE 06

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 06

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 IV PROPERTIES OF SURFACES 08

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 by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V **FRICTION** **08**

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

MODULE VI **LAWS OF MOTION** **10**

Review of laws of motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

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

Definition, 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 hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection,

processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES 6

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

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, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the

exploitation of these resources.

- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II (LABORATORY)	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, "Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.

4. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language (Ansi C Version)”, Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Implement algorithms in C++ Language.
- Write simple programs using concepts of object-oriented programming.
- Demonstrate the Object-Oriented Programming concepts applied in networking, web development and Database applications.

ITC1201 DIGITALPRINCIPLES AND APPLICATIONS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To acquire the knowledge of various numbering systems and their applications
- Tounderstandthe different methodsforsimplificationofBooleanAlgebra
- To design and implement combinational logic circuits.
- To design and implement sequential logic circuits

MODULE I NUMBER SYSTEMS, CODES AND DIGITAL LOGIC 7

Binary Number System – Binary to Decimal Conversion – Decimal to Binary Conversion – Octal Numbers – Hexadecimal Numbers – The ASCII Code – The Excess-3-Code – The Gray Code – Digital Logic – The Basic Gates – NOT,OR,AND – Universal Logic Gates – NOR,NAND, AND-OR-Invert Gates – Boolean Laws and Theorems

MODULE II MAPPING AND TABULATION METHODS 7

Sum-of-Products Method –Truth Table to Karnaugh Map – Pairs, Quads, and Octets – Karnaugh Simplifications – Don't-care Conditions – Product-of-sums Method – Products-of-sums Simplifications – Simplification by Quine-McClusky Method.

MODULE III COMBINATIONAL LOGIC CIRCUITS 8

Multiplexers – De-multiplexers – Decoders –Encoders – Code converters - Parity Generators and Checkers – Magnitude Comparator –- Read-only-Memory – Programmable Array Logic – Programmable Logic Arrays – Binary Adder and Subtractor.

MODULE IV SEQUENTIAL LOGIC CIRCUITS 8

Flip-flops: RS Flip-flops, D Flip-flops, JK Flip-flops, T Flip-flops – Registers: Serial-In-Serial-Out, Serial-In-Parallel-Out, Parallel-In-Parallel-Out, 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.

LIST OF EXPERIMENTS:

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. Donald P.Leach, Albert Paul Malvino and Goutam Saha, 'Digital Principles an Applications', Tata McGraw Hill Education Private Limited, Seventh Edition, 2011.

REFERENCES:

1. M. Morris R. Mano andMichael D. Ciletti, 'Digital Design' , Pearson, Fourth Edition, 2011
2. John F. Wakerly, 'Digital Design – Principles and practices', Pearson Fourth Edition, 2014

OUTCOMES:

On completion of the course students will be able to:

- Know the fundamental concepts and techniques used in digital electronics.
- Understand and examine the structure of various number systems and codes.
- Apply the principles of Boolean algebra to manipulate and minimize logic expressions
- Apply the mapping and tabulation method to minimize and optimize logic functions of any level.
- Design and implement various combinational logic circuits.
- Design and implement various sequential logic circuits built with different flip-flops.

ITC1202 PROGRAMMING IN PYTHON

L	T	P	C
2	0	2	3

OBJECTIVES:

- To understand the fundamentals of python programming.
- To comprehend data types and conditional loops.
- To be familiar with functions and modules.
- To explore strings, sets and files.

Pre requisites: Computer Fundamentals, Programming in 'C' or 'C++'.

MODULE I PYTHON BASICS **8**

Introduction, executing simple programs, exploring python variables, operators and comprehend python blocks.

MODULE II DATA TYPES AND PROGRAM FLOW CONTROLS **7**

Basic data types, numeric data types, string and string operations, list data types and slicing, tuples and its types, conditional blocks, control statements, looping statements, break statements, for loop, while loop using strings and dictionaries.

MODULE III FUNCTIONS , PACKAGES AND MODULES **8**

Organize functions using python code, import libraries and methods internally and externally, usage of external packages, powerful functions in python, understanding packages.

MODULE IV BULIDING BLOCKS OF PYTHON – METHODS **7**

String and dictionary manipulations, list manipulation using inbuilt methods, Tuples and Sets, Files, Exception handling and programs.

Theory: 30 Hrs

Laboratory Practice

1. Implementation of simple python program by installing and exploring python IDE.
2. Programs to implement basic data types, tuples, strings, numeric data types and list data types.
3. Implement control statements and conditional blocks.
4. Implement looping statements – for, while and do-while.

5. Implement strings and dictionaries.
6. Programming using functions in python
7. Programming powerful functions in python.
8. Import basic packages and libraries and execute programs
9. Build methods using list and basic data structures.
10. Implement exception handling using python programs

Lab: 30 Hrs

Total Hours: 60

TEXT BOOKS:

1. Gowrishankar S.and Veena A, "Introduction to Python Programming", CRC Press, 2019
2. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
3. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

REFERENCES:

1. John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.

OUTCOMES:

Upon Completion of course the students will be able to :

1. Write and execute python programs
2. Develop simple python programs to solve problems using control statements.
3. Explore libraries in python and modular programs to functions
4. Develop data structures based on python programs

SEMESTER III

MAC 2181	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

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 8 + 2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7 + 3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7 + 3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8 + 2

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

MODULE VI Z – TRANSFORM 7 + 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 – 60

TEXT BOOKS

1. Kreyszig .E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., "Higher Engineering Mathematics", 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

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.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features - One-minute presentations (using Audacity/ Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work) - Understanding Negotiation, persuasion and marketing skills through Podcasts - Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues
Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments) - Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups - Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific) - Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). English Pronunciation in Use. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). Study Speaking: A Course in Spoken English for Academic Purposes (Second Edition). Cambridge University Press, UK.
3. Hurlock, B. Elizabeth (2011). Personality Development. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). English and Soft Skills. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

ITC2101 DATA STRUCTURES

L	T	P	C
3	0	2	4

OBJECTIVES:

To enable the students to

- depict the different problem-solving techniques and the need for data structures.
- be aware of the various abstract data types and their applications.
- know the tree ADT and their applications.
- understand and implement searching and sorting algorithms.
- recognize graphical representation and apply algorithms for path finding.
- apply the knowledge of data structures in practical applications.

(Prerequisite: Computer Fundamentals)

MODULE I PROBLEM SOLVING AND ABSTRACT DATA TYPES 7

Problem solving - Top-down Design – Efficiency- Analysis - Sample algorithms – Introduction to data structures – Data structure types – Abstract Data Types – Arrays – Structures – Unions – Pointers.

MODULE II LISTS, STACKS AND QUEUES 8

List ADT – Stack ADT – Queue ADT – Circular Queue – Double Ended Queue - Priority Queue – Array implementation of Stack and Queue – Singly Linked List – Doubly Linked Lists – Stack and Queue using Linked List.

MODULE III TREES AND HASHING 8

Preliminaries - Binary Trees - The Search Tree ADT - Binary Search Trees - AVL Trees - Tree Traversals – Binary Heap - Hashing - General Idea - Hash Function - Separate Chaining - Open Addressing - Linear Probing.

MODULE IV SEARCHING AND SORTING 7

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

MODULE V GRAPHS 8

Definitions - Topological Sort - Shortest-Path Algorithms - Unweighted Shortest Paths – Dijkstra's Algorithm - Minimum Spanning Tree – Prim's Algorithm - Applications of Depth-First Search - Undirected Graphs.

MODULE VI APPLICATIONS 7

Linked List - Maintaining an inventory -- Stack - conversion of infix to postfix expression, evaluation of arithmetic expression - Queue - scheduler in OS - Tree - Priority queue - Graph - Traveling Salesman Problem.

Total : 45 Hours

LIST OFEXERCISES:

1. Implementation of linear search and binary search
2. Array implementation of List ADT, STACK ADT, Queue ADT.
3. Implementation of Singly linked list (addition, deletion. Insertion in all positions)
4. Implementation of Doubly linked list (addition, deletion. Insertion in all positions)
5. Implementation of Stack and Queues using linked list.
6. Implementation of binary search tree.
7. Program for tree traversal (inorder, postorder, preorder)
8. Implementation of Quick sort, Merge sort, Shell sort.
9. Implementation of Dijkstra"s algorithms.
10. Implementation of Depth First search.
11. Implementation of Linked List, Stack and Queue in real world.

Practical: 20 Hours

L – 45; P – 20; TOTAL HOURS – 65

TEXTBOOK:

1. R. G. Dromey, "How to Solve it by Computer", Prentice-Hall of India, 2009.
2. M. A. Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education, 2007.

REFERENCES:

1. Ashok Kamthane, "Introduction to Data Structures in C", 2nd edition, Wiley Publishers, 2011.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy", 2nd

Edition, CareerMonk Publications, 2011.
3. S.K. Srivastava & Deepali Srivastava," Data Structures Through C in Depth" 2nd Edition, 2011, BPB Publications.
4. A.K.Sharma, “Data Structures using C”, Pearson Education, 2013.

OUTCOMES:

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

- Analyze the performance of algorithms.
- Describe how arrays, structures, unions and pointers are represented in memory.
- Exhibit an understanding of the abstract properties of various data structures such as lists, stacks and queues.
- Demonstrate the different methods for traversing trees and outline the concepts of hashing.
- Explain the various searching and sorting algorithms.
- Discuss about graph traversal algorithms.
- Choose an appropriate data structure and algorithm design method for a specified application.

ITC2102 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- have a thorough understanding of the basic structure and operation ofa digitalcomputer.
- explore the instruction set and addressing modes of a computer.
- study about thedifferenttypesofpipelining and processors
- discussindetailimplementation of fixed-point and floating-point addition,subtraction, multiplication &division.
- explorethedifferentwaysofcommunicatingwithI/OdevicesandstandardI/Ointerfaces.
- studythehierarchicalmemorysystemincludingcachememoriesandvirtualmemory.

MODULE I BASIC COMPUTER ORGANIZATION 7

Instruction codes – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle – Memory Reference Instructions – Input – output and Interrupt – Complete Computer Description – Design of Basic Computer – Design of accumulator Logic – Micro programmed Control – Control Memory – Address sequencing.

MODULE II CENTRAL PROCESSING UNIT 8

General Register Organization – Stack Organization –Instruction Formats – Addressing Modes – Data Transfer and Manipulation – Program Control – Reduced Instruction Set Computers.

MODULE III PIPELINE AND VECTOR PROCESSING 8

Parallel Processing – Pipelining – Arithmetic Pipeline – Instruction Pipeline – RISC Pipeline – Vector Processing – Array Processors.

MODULE IV COMPUTER ARITHMETIC 8

Addition and Subtraction Algorithms – Multiplication Algorithms – Division Algorithms – Floating Point Arithmeti Operations – Decimal Arithmetic Unit – Decimal Arithmetic Operations.

MODULE V I/O ORGANIZATION 7

Peripheral Devices – Input-Output Interface –Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt- Direct Memory Access – Input/ Output Processor – Serial Communication.

MODULE VI MEMORY ORGANIZATION 7

Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware - CASE study.

Total: 45 Hours

TEXTBOOK:

1. M. Morris Mano, “Computer System Architecture” Revised Third Edition, Pearson Education, 2017.

REFERENCES:

1. Smruthi Ranjan Sarangi, “Computer Organization and Architecture”, McGraw Hill Education (India) Pvt.Ltd., 2015.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 9th edition, Pearson, 2013.
3. Hohl, William, “ARM Assembly Language: fundamentals and techniques “, 2nd edition, CRC Press, 2014.
4. David A. Patterson and John L. Hennesey, “Computer Organization and Design- The Hardware / Software Interface”, 5th edition, Morgan Kauffman / Elsevier, 2014.
5. Carl Hamacher, ZvonkoVranesicandSafwatZaky,"ComputerOrganization",5th Edition, McGraw-Hill,2011

OUTCOMES:

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

- Discuss the central ideas in computer organization and show the relationship between hardware and software of a computer.
- Describe various operations and operands of computer hardware and representation of instructions.
- Explain the importance of Pipelining and parallel processing.
- Explain how a computer performs arithmetic operations and decimal arithmetic operations.
- Outline the I/O Organization, interrupts and interfaces.
- Compile the concepts of memory organization.

ITC2103	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to

- understand the computer networking basics and the functions of different layers in OSI Model and TCP-IP Model.
- acquire the knowledge about the different error detection and correction methods and how the data flow is controlled in data communication.
- learn the internetworking protocols and how to apply the sub netting scheme to efficiently use the IP addresses by reducing the wastage of addresses.
- be conversant with the various transmission control protocols and congestion control mechanisms.
- be familiar with various application layer protocols.
- learn about cryptographic techniques and algorithms for network security.

Prerequisite: Computer Fundamentals

MODULE I INTRODUCTION TO COMPUTER NETWORKS 7

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 8

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 8

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 **8**

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 **7**

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

MODULE VI SOFTWARE DEFINED NETWORKS **7**

Need for SDN : Evolution of switches and control panel, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs – Genesis of SDN: The Evolution of Networking Technology, Forerunners of SDN, Open Source Contributions to SDN – Working Principles of SDN: Fundamental Characteristics of SDN, SDN operation, SDN Devices, SDN Controller and SDN applications.

Total : 45 Hours

TEXTBOOK:

1. BehrouzA.Forouzan,"DataCommunicationandNetworking", 4th Edition, TataMcGraw-Hill,2017.

REFERENCES:

1. James F. Kurose and Keith W. Ross, "Computer Networking: ATop-DownApproachFeaturingtheInternet", Fifth Edition,PearsonEducation,2017.
2. Andrew S. Tanenbaum, David.J.Wetherall "Computer Networks", Fifth Edition, Pearson Education,2013.
3. William Stallings, "Data and Computer Communication", TenthEdition,PearsonEducation, 2017.
4. Paul Goransson, Chuck Black, and Timothy Culver**"**Software Defined Networks:A Comprehensive Approach", Second Edition, PearsonEducation, 2016.

OUTCOMES:

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

- DiscusstheterminologyandconceptsoftheOSIreferencemodel & TCP-IP model and the various technologies & standards related networks.
- Apply the error detection & correction methods and compare various flow control mechanisms in data communication.
- Design and apply appropriate subnetting scheme upon analyzing the requirements of the organization networking structure.
- Illustrate the role of various transmission control protocols, how congestion in the networks can be controlled.
- Explain the various services provided by network and apply cryptographic techniques and algorithms for network security.
- Discuss the need for software defined networks and their working principles and characteristics.

ITC2104	ADVANCED JAVA AND INTERNET PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To install and setup Java environment and to learn Java basics
- To develop Java application using swing and AWT
- To explore advanced Java concepts
- To have hands on experience in Internet Programming.

MODULE I JAVA BASICS 8

Introduction to Java – evolution – variables and data types - arrays- operators- control structures- methods- implementation of object-oriented concepts – exception handling.

MODULE II MULTI THREADING AND I / O STREAMS 7

Multithread programming, thread creation, inter process communication, synchronization-i/o basics- generic programming – string handling-collections.

MODULE III INTRODUCTION TO GUI PROGRAMMING 8

AWT – using AWT Controls - Event Handling -SWING - Applets and Applications- JavaFX Programming.

MODULE IV JAVA OPEN DB AND RICH INTERNET APPLICATIONS 7

Introduction to databases – SQL-MySQL-Java DB / Apache Derby – Java API with XML-AJAX-Rich Internet Applications with XML and JSON.

MODULE V INTERNET PROGRAMMING FUNDAMENTALS 7

Introduction to HTML5 - cascading Style Sheets -Java Script- functions-arrays – objects- DOM- event handling.

MODULE VI INTERNET PROGRAMMING FRAMEWORKS 8

Java Beans- Servlets – JSP– Session Management – Cookies – Java Web Start – Java Plug-Ins – Deployment, Plug-In and Web Start Tools –– Installing and Configuring Apache Tomcat Server- Jboss Server.

Total Hours: 45

TEXT BOOKS:

1. Herbert Schildt, “Java 2 – The Complete Reference”, Nineth Edition, Tata McGraw Hill, 2014.
2. Deitel and Deitel and Nieto “Internet and World Wide Web-How to Program”, Prentice Hall, 6th Edition, 2012.

OUTCOMES:

Upon Completion of course the students will be able to:

- become familiar with the Java environment
- develop Java application using Swings and Middleware technology
- develop Applet and AWT based Java Applications
- apply java concepts to develop frontend and backend applications
- use client side and server side scripting
- explore internet application frameworks

ITC2106	NETWORK CONFIGURATIONLAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To enable the students to

- study the tools and commands for constructing and maintaining networks.
- configure the IP addresses in the Network devices.
- configure the various routing protocols and enable the different networks to communicate with each other.
- configure the Access control lists in a network topology.
- configure VLANs on the switches in a network topology.

LIST OFEXERCISES:

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 Wide Area Network (WAN) with various classes of IP address and configured with RIP protocol.
5. Creating a WAN with subnetted IP addresses and configured with IGRP protocol.
6. Creating a WAN with variable length subnetted IP addresses and configured with RIP Ver 2 Protocol.
7. Creating a WAN with variable length subnetted IP addresses and configured with EIGRP protocol.
8. Creating a WAN with variable length subnetted IP addresses and configured with OSPF protocol.
9. Creating an Access controlled WAN with variable length subnetted IP addresses and configured with any one of the routing protocol.
10. Configuration of Virtual LAN on the switches in a network topology

Total: 30 Hours

OUTCOMES:

On completion of the course students will be able to:

- Design and implement a WAN with a distance vectored routing protocol.

- Design and implement a WAN with a link-state routing protocol.
- Design and implement a WAN with VLSM and appropriate classless inter-domain

  Routing protocol
- Design and implement a WAN with VLAN configured switches.
- Design and implement a WAN with communication restricted through ACLs.

ITC2107	ADVANCED JAVA AND INTERNET PROGRAMMING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To enable the students to

- acquire practical experience on core java programming.
- have hands on experience in advanced concepts of java programming.
- gain hands on experience in Internet Programming.

EXPERIMENTS:

1. Java program using AWT GUI components.
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 group etc.
4. Programs to implement Java swing components.
5. Java programs to implement thread, thread priority, multi thread concepts.
6. Java programs for database connectivity using JDBC-ODBC connectivity.
7. Installation and working of webserver like Apache Tomcat and application servers glassfish.
8. Java programs to create three-tier applications using servlets and JSP.
9. Create a web page using HTML (i.e include map, hotspots).
10. Create a web page with various kind of style sheets.
11. Demonstration of Java Script, JQuery, and Ajax.
12. XML and Java API for XML web services.

Total Hours : 30

OUTCOMES:

Upon Completion of course the students will be able to

- become familiar with the Java environment.
- develop Applet, AWT, and Swing based Java Applications.
- practice advanced Java concepts.
- practice Markup languages and programming.
- work in the Internet frameworks.

SEMESTER IV

ENC2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academicand professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information. -Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting - Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter - Writing Functional résumé and letter of application using Edmodo.

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer - Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education) -- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan, D (2013). Technical Report Writing Today. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J. (2012). Writing that Works: Communicating Effectively on the Job. Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). HBR Guide to Better Business Writing (HBR Guide Series). Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). Business Correspondence and Report Writing. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). Academic and Professional Writing for Teachers. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). Business Benchmark: Pre-Intermediate to Intermediate. Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

ITC2212	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe essential features of database management systems and its use.
- Familiar to identify about the procedural and non-procedural language.
- Mastering the design principles of databases, as well as in the normalization approach.
- To provide the description of physical file structures and access methods
- Master the advanced topics and current trends.

MODULE I BASIC CONCEPTS 7

General Introduction to database and Transactions -Traditional file system and database - Database system three-tier architecture - various components of database- Data models - Modeling using ER model – UML – OLTP Vs OLAP

MODULE II RELATIONAL ALGEBRA AND SQL LANGUAGE 8

Unary Operations: Select and Project - Relational Set operations - Binary Relational operators. SQL: Data definition Language, Data Manipulation Language, Data Control Language in SQL - Basic constraints in SQL - Basic Queries in SQL- Joins, Aggregate & SORT functions -SQL Views and Privileges.

MODULE III DATABASE DESIGN AND DATA STORAGE 8

Importance of 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. Storage File organization: Memory Hierarchies - Secondary Storage devices - Magnetic tape storage device. Files - Fixed length and Variable length records. Operations on files: Sorted Files - Heap Files-Hashing and overflow handling techniques.

MODULE IV INDEXING AND TRANSACTION PROCESSING 8

What is Indexing? Advantages of Indexing; Indexing structure for files: Different type of single-level ordered index- Multi level index-Dynamic multilevel indexing using B tree and B+ trees: Create Index using SQL; 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. Characterizing schedules based on Recoverability: Recoverable - Non-recoverable schedules - cascading rollback and cascade less schedule. – What is SQL Tuning?

MODULE V CONCURRENCY AND RECOVERY TECHNIQUES 8

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 - Database recovery techniques: Immediate update, deferred update, Shadow paging, and Checkpoint.

MODULE VI ENHANCED DATA MODELS 6

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

Total Hours: 45

TEXT BOOKS:

1. Silberschatz, A., Korth, H. F., & Sudarshan, “Database system concepts” McGraw-Hill. ,(International Edition) (6th ed.). New York, 2011.
2. Elmasri, R., & Navathe, S. B. “Fundamentals of database systems” (6th ed.) Pearson Education, 2011.

REFERENCE BOOKS:

1. Raghu Ramakrishnan, “Database Management System”,3rd Edition, Tata McGraw-Hill Publishing Company, 2003.
2. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, 5th edition, 2003.
3. C J Date, “An Introduction to Database System”, 8th Edition, 2004.
4. Hector Garcia–Molina, Jeffrey D. Ullman and Jennifer Widom- “Database System Implementation”, Pearson Education, 2000.

OUTCOMES:

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

- Summarize the vital concepts and architecture associated with DBMS
- Describe relational database using SQL.
- Apply normalization techniques in database design.
- Use the transaction processing and concurrency control for application software.
- Utilize the query evaluation techniques and query optimization.
- Apply the knowledge in current trends of database system.

ITC2213	OPERATING SYSTEMS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To enable the students to

- Study about different types of system software and operating systems.
- understand the concepts of process scheduling and compare the various scheduling algorithms.
- acquire the knowledge about critical section problem and how the solution is provided
- explain conditions that lead to deadlock and the different methods to handle the deadlock.
- understand the concepts of various memory management schemes.
- learn about the file and disk management.

Prerequisite: Computer Programming and Computer Architecture

MODULE I INTRODUCTION TO SYSTEM SOFTWARE AND OPERATING SYSTEM **8**

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, Multimedia, Open Source, Android – Computing Environments – System Components – Operating System Design & Implementation – Operating System Structure

MODULE II PROCESS SCHEDULING **7**

Overview of Process, Memory, File and Disk Management-Process Management-Process Concepts – Schedulers – Process Scheduling: Algorithms, Multiple-Processor & Real-Time Scheduling – Threads: Overview, Threading Issues, Thread Scheduling.

MODULE III PROCESS SYNCHRONIZATION **7**

Operations on Processes – Inter-Process Communication – Process Synchronization: Critical-Section Problem, Semaphores, Classic Problems of Synchronization, Critical Region-Monitors.

MODULE IV DEADLOCKS AND SYSTEM PROTECTION 7

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 V MEMORY MANAGEMENT 8

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 VI FILE AND DISK MANAGEMENT 8

File Concepts – Access Methods – Directory Structure– File System Structure – File System Implementation– Virtual File System: Network File System – Distributed File System – File System Mounting – File Sharing & Protection: File Locking- Disk Structure – Disk Scheduling– Disk Management, Case study-UNIX Operating System.

Lecture: 45 Hours

LIST OF EXPERIMENTS

1. Study of 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. Creation of Virtual Machines
13. Implementation of File-locking concept.
14. Implementation of disk scheduling algorithms (SCAN, C-SCAN & LOOK)

L: 45 Hours, P: 30 Hours Total: 75 Hours

TEXTBOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2013.

REFERENCES:

1. LelandL.Beck,"SystemSoftware-AnIntroductiontoSystemsProgramming",3rdEdition,PearsonEducationAsia,2000.
2. Harvey M. Deitel, 'Operating Systems', Second Edition, Pearson Education Pvt. Ltd, 2002.
3. Andrew S. Tanenbaum, 'Modern Operating Systems', Prentice Hall of India Pvt. Ltd, 2003.
4. William Stallings, 'Operating System', Prentice Hall of India, 4th Edition, 2003.
5. Pramod Chandra P. Bhatt – 'An Introduction to Operating Systems, Concepts and Practice', PHI, 2003.

OUTCOMES:

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

- discuss the different types of system software and operating systems
- analyze the different CPU scheduling algorithms
- use appropriate schemes for providing process synchronization
- discuss how the deadlock can be managed / avoided.
- illustrate the various memory management schemes.
- explain the concepts of file and disk management

ITC2214 SOFTWARE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- understand various software process models.
- acquire the knowledge about software requirements engineering.
- Understand the fundamental concepts of software design.
- learn software design techniques.
- comprehend software testing techniques.
- understand software project management concepts.

Prerequisite: Computer Programming

MODULE I SOFTWARE PROCESS MODELS 8

The Software Process - Software Engineering Practice - Software Development Myths - Software Process Structure - Process Models - Agile Process Models - Agile Teams.

MODULE II SOFTWARE REQUIREMENTS 8

Requirements Engineering - Establishing The Groundwork - Eliciting Requirements - Developing Use Cases - Building The Analysis Model - Scenario-Based Modeling: Requirements Analysis - Scenario-Based Modeling - Class-Based Methods: - Requirements Modeling for Web And Mobile Apps.

MODULE III SOFTWARE DESIGN FUNDAMENTALS 7

The Design Process - Design Concepts - The Design Model - Software Architecture - Architectural Styles - Component-Level Design: - Designing Class-Based Components - Component-Level Design for Webapps - Component-Level Design for Mobile Apps.

MODULE IV SOFTWARE DESIGN 7

User Interface Design: The Golden Rules - Interface Design Steps - Webapp And Mobile Interface Design - Design Evaluation - Pattern-Based Software Design.

MODULE V SOFTWARE TESTING 8

Test Strategies for Conventional Software - Test Strategies for Object-Oriented Software - Test Strategies for Webapps - Test Strategies for Mobileapps - Validation Testing - System Testing - The Art of Debugging - White-Box Testing Techniques - Black-Box Testing Techniques - Testing Object-Oriented Applications - Testing Concepts For Webapps - Testing Web Applications - Testing Mobileapps.

MODULE VI MANAGING SOFTWARE PROJECTS 7

Introduction To Software Configuration Management - Project Management Concepts - Empirical Estimation Models - Estimation For Object-Oriented Projects - The CMMI -

Total : 45 Hours

TEXTBOOK:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 8th Edition, McGraw Hill Publication, 2015.

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.

OUTCOMES:

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

- select the suitable software process model to develop the software successfully.
- prepare requirements specification document and analyze the requirements.
- explain software design concepts.
- design a software for given requirements to develop a quality software.
- develop test case specification and to test the software using both white-box and black-box testing techniques.
- explain about the software project management concepts.

ECC2208 SIGNALS AND SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of Signals and Linear Time-Invariant Systems
- To illustrate various Transform such as Fourier, Laplace, Z-Transform etc. for signal processing applications

PREREQUISITES:

- Fundamentals of Engineering Mathematics

MODULE I INTRODUCTION TO SIGNALS 7

Discrete and Continuous Signals. Standard elementary signals, Basic operations on signals. Energy and Power of signals.

MODULE II INTRODUCTION TO LTI SYSTEMS 8

Continuous-Time and Discrete-Time Systems, Linear Time Invariant (LTI) Systems and its Properties, Impulse Response, Discrete-time and Continuous-time convolution and Correlation.

MODULE III FOURIER SERIES ANALYSIS 7

Fourier Series representation of signals. Properties of Fourier Series. Complex exponential Fourier Series

MODULE IV FOURIER TRANSFORM ANALYSIS 8

Continuous-Time Fourier Transform and its properties. Frequency Response of CT-LTI Systems. Discrete-Time Fourier Transform (DTFT) and its properties.

MODULE V LAPLACE TRANSFORM ANALYSIS 8

Unilateral and Bilateral Laplace Transform. Region of Convergence (ROC), Properties of Laplace Transforms. Poles and Zeros. Inverse Laplace Transformation.

MODULE VI Z- TRANSFORM ANALYSIS 7

Z-Transform. Z-Plane and ROC. Properties of Z-Transform. Poles and Zeros. Methods for Inverse Z-Transform

Total Hours –45

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky, with S. Hamid Nawab, "Signals and Systems", 2nd Edition, Pearson Education, 2015. (ISBN: 9789332550230)
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India Pvt Ltd., 2007. (ISBN: 9788126512652)

REFERENCES:

1. Hwei P. Hsu, "Signals And Systems", 3rdEdition, Schaum's Outlines, McGraw Hill Education, 2017.
2. Won Young Yang, "Signals and Systems with MATLAB", 1st Edition, Springer, 2011.
3. Simon Haykin & Michael Moher, “Communication Systems”, 5th Edition, Wiley India Pvt Ltd., 2009.
4. John G. Proakis & Dimitris G Manolakis , “Digital Signal Processing : Principles, Algorithms, and Applications”, 4 Edition, Pearson India, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Mathematically represent and classify the signals
- Mathematically represent and classify the systems
- Evaluate and manipulate signals mathematically.
- Identify, and characterize common LTI Systems.
- Apply the tools such as Fourier Series and Fourier Transform in problem solving.
- Apply the Laplace Transform and Z-Transform in problem solving

ITC2215 **DBMS LAB** **L T P C**
0 0 3 1

OBJECTIVES:

To enable the students to

- know how to create a database and query it using SQL.
- understand the importance of Referential and Integrity constraints.
- know how to work with PL/SQL.
- be aware of database connectivity for developing an application.

LIST OF EXERCISES:

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.

Total Hours: 45

OUTCOMES:

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

- Apply SQL DML/DDL commands for creating a database.
- Demonstrate PL/SQL programming.
- Develop small-scale database oriented applications.

SEMESTER V

MSC 3181	LEADERSHIP & CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it.
- Assisting students in enhancing their expressive ability and inducing a high level of self-confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traitsthrough psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 8

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 8

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder- empowering

people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. Leader as an inspirer- motivation and leadership, recognizing and appreciating contributions, empowering others to lead Leader as an innovator –leader's role in shaping culture and values in an organization. Leader as a Liaison- Leader as team player.

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 9

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact. -Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid.

MODULE V LEADERSHIP AND CEO TRAINING 8

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

MODULE VI TEACHING PEDAGOGY

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

Total Hours –45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education,

2013.
3. Richard L Daft , “Leadership”, 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman, Richard Boyatzis and McKee, Harvard Business Review Press.

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi.
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fit between individual and their entrepreneurial ambitions.
- To identify the customers and find a problem worth solving.
- To create a business model for solving the problems of customer, forming solution and present the Business Model Canvas
- To develop a solution for customers' problem and analyze the problem solution fit & product market fit.
- To build and demonstrate a Minimum Viable Product (MVP) for startup.
- To analyze and understand the impact of social entrepreneurship on society and cases.

MODULE I SELF & OPPORTUNITY DISCOVERY 9

Finding the flow, Effectuation, Entrepreneurial Style, Business Opportunities, Problem Identification, Design Thinking, Potential solutions, Presentation of the problem- Case Study.

MODULE II CUSTOMER , SOLUTION AND BUSINESS MODEL 9

Customers and Markets, Identification of Customer Segment, Niche Segment, Customers Jobs, Pain and Gain, Early Adopters, Value Proposition Canvas, Basics of Business Model and Lean Canvas, Risk and Assumptions.

MODULE III VALIDATION AND MONEY 9

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 TEAM BUILDING AND MARKETING 7

Shared Leadership, Hiring, Fitment , Team Role and Responsibilities , Collaboration Tools and Techniques, Positioning and Branding, Channels

MODULE V SALES & SUPPORT 6

Sales Planning, Selling Skills, Project Management, Project Tracking, Basic of Business Regulation, Startup.

MODULE VI IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES **5**

Impact of Social Entrepreneurship, NGO vs For-Profit Companies vs. Social Entrepreneurship. Procedures for registration of small scale industry, Overview of venture capital and angel investment, Social entrepreneurship report preparation by students. Case Study of Social Entrepreneurs.

Total Periods- 45

TEXT BOOKS

1. Entrepreneurship Rajeev Roy oxford, 2012.
2. Learn wise platform - Wadhwani Foundation, 2018
3. “Social Entrepreneurship and Social Business” Christine K Volkmann, Springer Gabler 2012.
4. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.

REFERENCES

1. Social Entrepreneurship” Manuel London, Routlege, 2012.
2. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.
3. Running Lean: Iterate From Plan A To a Plan That Works, Ash Maurya, "O'Reilly Media, Inc.", 28-Feb-2012.

OUTCOMES:

On completion of the course, students will be able to

- Build an entrepreneurial mindset and reach out the customer to identify the problem using design thinking process
- Craft solution to the problem through value proposition canvas and develop a business model using lean canvas
- Provide product solution demo and deliver a minimum viable product
- Work as a team and create brand strategy marketing for product/service
- Prepare, make an outstanding sale pitch for startup.
- Showcase the impact of Social Entrepreneurship on society and cases.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CONFIDENCE BUILDING	L 0	T 0	P 2	C 1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey, S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016). Step up: Confidence, Success and Your

Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993). How to Develop Self-Confidence. Amazon.com
4. Wentz, F.H. (2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem-based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

ITC3101	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Object Oriented life cycle.
- To know how to identify objects, relationships, services and attributes through UML.
- To provide knowledge in Object Oriented Design process.
- To analyze about software quality and usability.

MODULE I INTRODUCTION **7**

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

MODULE II OBJECT ORIENTED METHODOLOGIES **8**

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 **8**

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

MODULE IV OBJECT ORIENTED DESIGN - I **7**

Design axioms - Designing Classes

MODULE V OBJECT ORIENTED DESIGN - II **8**

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

MODULE VI SOFTWARE QUALITY AND USABILITY **7**

Designing Interface Objects - Software Quality Assurance - System Usability - Measuring User Satisfaction

Total Hours: 45

TEXT BOOKS:

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999.
2. Martin Fowler, "UML Distilled", 3rd 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.

OUTCOMES:

On completion of the programme students will be able to:

- Outline the basics of object oriented system development life cycle.
- Explain the various UML diagrams.
- Analyze software requirements to identify objects, attributes and methods.
- Prepare design for software using UML diagrams.
- Outline how to identify requirements, analyze requirements and prepare design for application and real-time software.
- Explain how to develop user friendly software.

ITC3102 FUNDAMENTALS OF WEB DESIGNING

L	T	P	C
2	0	2	3

OBJECTIVES:

- To introduce the basics of web designing
- To discuss methods and techniques to create simple to complex websites.
- To explore prevailing vocabulary in web development in creating social media websites.
- To focus on client side and server side scripting languages.
- To discuss about software's and services that are easily incorporated in a website.

MODULE I INTRODUCTION 8

Introduction to web design environment, role of web designers, basics of scripting and programming, need of multimedia, tools and equipment's assisting web designing, working of web, browser server communication, web page address, anatomy of a web page, Multitude of devices in web, standards in web, responsive web design.

MODULE II STRUCTURE OF WEB PAGE AUTHORING 7

Introduction – First XHTML Example, Headers, Linking, Images, Special Characters, Unordered Lists, Nested and Ordered Lists, Basic XHTML Tables, Basic HTML Forms. Internal Linking, Meta Elements, Framesets, Forms and creation of Forms.

MODULE III PROGRAMMING WITH JAVASCRIPT 8

Introduction to scripting, simple program, memory concepts, arithmetic, decision making statements, control structures, JavaScript functions, objects, dynamic html event model.

MODULE IV STYLING WITH CSS 7

Introduction, Inline styles, embedded style sheets, conflicting styles, linking external style sheets, W3C CSS validation services, positioning elements, Backgrounds, element dimensions, text flow and box model, user style sheets, internal style sheets.

Total Hours: 30

REFERENCES:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.) – Springer – 2011.
3. Designing internet of things –Adrian McEwen & Hakim Cassimally – Jhon Wiley and sons – 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

OUTCOMES:

Upon Completion of course the students will be able to:

- Create local HTML pages and move them to a remote web server.
- Design and develop basic web pages using HTML and CSS.
- Use graphics and tables in Web pages.
- Link pages so that they create a Web site.

ITC3103 MICROPROCESSORS AND MICROCONTROLLER

L	T	P	C
3	0	2	4

OBJECTIVES:

- To study the architecture and Instruction set of8086
- To develop assembly language programs in8086.
- To understand and design multiprocessorconfigurations.
- Tostudydifferentperipheraldevicesandtheirinterfacingto8086.
- To study the architecture and programming of 8051microcontroller.

MODULE I 8086 ARCHITECTURE **8**

Introduction to 8086 Microprocessor, Minimum and Maximum Mode Signals, Architecture, Memory Organization, Interruptstructureof8086, Introduction to Advanced Microprocessors.

MODULE II INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086 **8**

Instructionformats,addressingmodes,Instruction Set of 8086, String Manipulations, assemblerdirectives, Procedures and Macros, Assembly Language Programming.

MODULE III I/OINTERFACING **7**

Memory Interfacing, I/O Interfacing, Parallel Communication Interface, 8255 PPI Architecture and Interfacing, Serial Communication Interface, 8251 USART Architecture and Interfacing, Real Time Applications.

MODULE IV INTERFACING WITH ADVANCED DEVICES **7**

Interrupt service routine, Programmable Interrupt controller 8259 Architecture and Interfacing, Introduction to Timer/ Counter Controller 8253, Keyboard/Display Controller 8279 and DMA Controller 8257, Simple Applications.

MODULE V 8051 MICROCONTROLLER **7**

Introduction, Signals of 8051, Architecture, MemoryOrganization, Interrupt Structure, Serial & Timer control.

MODULE VI 8051 REAL TIME CONTROL **8**

Addressing Modes and Instruction set of 8051, Programming Timer interrupts, external hardware interrupts and serial communication interrupts, Real Time

Applications using 8051, Introduction to Embedded System.

Total Hours : 45

LIST OF EXPERIMENTS

1. Implementation of 8-bit Operations using 8086 microprocessor kit
2. Implementation of 16-bit Operations using 8086 microprocessor kit
3. Implementation of simple programs using array using 8086 microprocessor kit
4. Implementation of Decimal Arithmetic using 8086 microprocessor kit
5. Implementation of Code Conversions using 8086 microprocessor kit
6. Programming with 8086 - String manipulation, search, find and replace, copy operations, sorting (PC Required)
7. Implementation of Keyboard control, display, file manipulation using BIOS/DOS calls (PC Required)
8. Implementation of Disk operations using BIOS/DOS calls . (PC Required)
9. Implementation of Interfacing with 8086 - 8255, 8253.
10. Implementation of Interfacing with 8086 - 8279, 8251.
11. Implementation of Stepper motor interfacing
12. Implementation of 8051 Microcontroller based experiments - Simple assembly language programs. (cross assembler required)
13. Implementation of 8051 Microcontroller based experiments - Simple control applications (cross assembler required)

Lecture: 45 Hours, Practical: 30 Hours Total: 75 Hours

TEXTBOOKS:

1. K. Ray and K.M. Bhurchandani, "Advanced Microprocessorsand Peripherals- TMH", 2nd edition,2006.
2. Subrata Ghoshal,"8051 Microcontroller Internals, Instructions, Programming and Interfacing", Pearson Education, 2010.

REFERENCES:

1. K.Uma Rao, Andhe Pallavi, "The 8051 Microcontrollers, ArchitectureandprogrammingandApplications",PearsonEducation, Sixth Edition, 2013.
2. D. V. Hall, "Micro processors and Interfacing",1st edition,2006.

3. Kenneth. J. Ayala , "The 8051 microcontroller", 3rd edition, Cengagelearning,2010.

OUTCOMES:

- Explain the internal architecture of 8086 Microprocessor.
- Develop assembly language programs using 8086 instructions.
- Design and demonstrate I/O interfacing concepts and programming techniques using 8255 and 8251 for simple applications.
- Design and demonstrate I/O interfacing concepts and programming techniques using 8259, 8253, 8279 and 8257 for simple applications.
- Explain the internal architecture of 8051 Microcontroller.
- Develop simple programs and real time control applications using 8051 instructions.

ITC3104	CASE TOOLS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- Define the process of object-oriented analysis and design to software development.
- Pointing out the importance and function of each UML model throughout the process of object-oriented analysis and design and explaining the notation of various elements in these models.
- Providing students with the necessary knowledge and skills in using object oriented CASE tools.

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, Infrastructure.
2. Software Requirements Analysis.
   Develop Scenario-based Model, Class-based Model, and Behavioral Model.
3. Data Modelling.
   Use work products -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 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
11. Satellite Navigation System

Total Hours: 45

OUTCOMES:

Students on successful completion of the course should have gained the following skills

- Show the importance of systems analysis and design in solving complex problems.
- Show how the object-oriented approach differs from the traditional approach to systems analysis and design.

SEMESTER VI

MSC 3181	LEADERSHIP & CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it.
- Assisting students in enhancing their expressive ability and inducing a high level of self-confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traitsthrough psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 8

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 8

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder- empowering

people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. Leader as an inspirer- motivation and leadership, recognizing and appreciating contributions, empowering others to lead Leader as an innovator –leader's role in shaping culture and values in an organization. Leader as a Liaison- Leader as team player.

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 9

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact. -Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid.

MODULE V LEADERSHIP AND CEO TRAINING 8

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

MODULE VI TEACHING PEDAGOGY

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

Total Hours –45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education,

2013.
3. Richard L Daft, “Leadership”, 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press.

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi.
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fit between individual and their entrepreneurial ambitions.
- To identify the customers and find a problem worth solving.
- To create a business model for solving the problems of customer, forming solution and present the Business Model Canvas
- To develop a solution for customers' problem and analyze the problem solution fit & product market fit.
- To build and demonstrate a Minimum Viable Product (MVP) for startup.
- To analyze and understand the impact of social entrepreneurship on society and cases.

MODULE I SELF & OPPORTUNITY DISCOVERY 9

Finding the flow, Effectuation, Entrepreneurial Style, Business Opportunities, Problem Identification, Design Thinking, Potential solutions, Presentation of the problem- Case Study.

MODULE II CUSTOMER , SOLUTION AND BUSINESS MODEL 9

Customers and Markets, Identification of Customer Segment, Niche Segment, Customers Jobs, Pain and Gain, Early Adopters, Value Proposition Canvas, Basics of Business Model and Lean Canvas, Risk and Assumptions.

MODULE III VALIDATION AND MONEY 9

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 TEAM BUILDING AND MARKETING 7

Shared Leadership, Hiring, Fitment , Team Role and Responsibilities , Collaboration Tools and Techniques, Positioning and Branding, Channels

MODULE V SALES & SUPPORT 6

Sales Planning, Selling Skills, Project Management, Project Tracking, Basic of Business Regulation, Startup.

MODULE VI IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES **5**

Impact of Social Entrepreneurship, NGO vs For-Profit Companies vs. Social Entrepreneurship. Procedures for registration of small scale industry, Overview of venture capital and angel investment, Social entrepreneurship report preparation by students. Case Study of Social Entrepreneurs.

Total Periods- 45

TEXT BOOKS

5. Entrepreneurship Rajeev Roy oxford, 2012.
6. Learn wise platform - Wadhwani Foundation, 2018
7. “Social Entrepreneurship and Social Business” Christine K Volkmann, Springer Gabler 2012.
8. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.

REFERENCES

4. Social Entrepreneurship” Manuel London, Routlege, 2012.
5. The Process of social value creation: A multiple case study on Social Entrepreneurship in India, Archana Singh Springer 2016.
6. Running Lean: Iterate From Plan A To a Plan That Works, Ash Maurya, "O'Reilly Media, Inc.", 28-Feb-2012.

OUTCOMES:

On completion of the course, students will be able to

- Build an entrepreneurial mindset and reach out the customer to identify the problem using design thinking process
- Craft solution to the problem through value proposition canvas and develop a business model using lean canvas
- Provide product solution demo and deliver a minimum viable product
- Work as a team and create brand strategy marketing for product/service
- Prepare, make an outstanding sale pitch for startup.
- Showcase the impact of Social Entrepreneurship on society and cases.

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CAREER CHOICE	0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)-Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown, D.(2002). Career Choice and Development. Wiley, J.& Sons.USA
2. Lore, N. (1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R. (2013). Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

ITC3211	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students:

- To discuss the distinctions between different levels of testing.
- To describe the principles of software testing and maturity levels.
- To describe strategies for generating system test cases.
- Develop the software testing metrics.
- To understand the essential characteristics of tool used for test automation.
- Demonstrate the ability to apply multiple methods to develop reliability estimates for a software system.

MODULE I SOFTWARE TESTING-INTRODUCTION 8

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 8

Introduction to Testing Design Strategies - The Smarter Tester -Test Case Design Strategies - Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing Using White-Box Approach to Test design - White-box Based Test Design - Additional White Box Test design approaches.

MODULE III LEVELS OF TESTING AND TESTING GOALS, PLANS AND POLICIE 8

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 7

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 7

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.

MODULE VI TESTERS WORKBENCH 7

Defect analysis and prevention-Defect casual Analysis-Evaluating Testing Tools for the workbench-Tool categories-process reuse-Approach to model development-TMM structure-TMM Assessment model components.

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 – Principlesand Practices", Pearson education, 2006.
3. Ilene Burnstein, "Practical Software Testing", Springer, 2003.

REFERENCES:

1. Limaye L G, "Software Testing - Principles, Techniques and Tools", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009.
2. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education, 2008.
3. Boris Beizer, "Software Testing Techniques", 2nd Edition, Dreamtech, 2003.

OUTCOMES:

Students who have completed this course would have learned

- Various test processes and continuous quality improvement
- Types of testing techniques and developing test case design
- Writing proper test plan for an application
- Build a test group and how to control and monitoring the testing process.
- Various test measurement techniques and review techniques
- The use of various test tools

ITC3212 CLOUDCOMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about cloud computing basics.
- Toknowthevarioustechnologiesavailableforcloud platforms.
- To understand the cloud storage service and standards to access cloud service providers.
- To learn virtualization technology over various open source cloud tools to monitor the cloud performance.
- To understand security and challenges incloud.

MODULE I CLOUD COMPUTINGBASICS **8**

Introduction to Cloud Computing - Essential Characteristics - ArchitecturalOverview–CloudDeliveryModels-ServiceModels–Deploymentmodels– Cloud computing vendors – Benefits of cloud computing –Limitations.

MODULE II CLOUD COMPUTINGTECHNOLOGY **7**

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.

MODULE III CLOUD STORAGE ANDSTANDARDS **8**

StorageasaService–CloudStorageProviders - CloudFileSystems-GFSandHDFS– BigTable,HBaseandDynamoDB–CloudDataStore–SimpleStorage Service.

MODULE IV VIRTUALIZATION TECHNOLOGY **7**

Virtualization Technology - Overview - Virtual Machines Provisioningand Manageability - Virtual Machine Migration Services - VM ProvisioningandMigrationinAction - VMLifeCycleandVMMonitoring - AmazonElasticCompute Cloud.

MODULE V DATA CENTER TECHNOLOGY **7**

Virtualization – Automation – Remote Operation and Management – Computing Hardware – Storage Hardware – Network Hardware – Carrier and External Network Interconnection – Web Tier Load Balancing and Acceleration.

MODULE VI CLOUD SECURITY **8**

Cloud Security Fundamentals- Terms and Concepts- Threat Agents – Anonymous Attacker - Malicious Service Agent - Trusted Attacker - Malicious Insider -Cloud Security Threats - Traffic Eavesdropping- Malicious Intermediary -Denial of Service - Insufficient Authorization - Virtualization Attack - Overlapping Trust Boundaries – Case Study example for IaaS, PaaS, SaaS.

Total Hours: 45

TEXTBOOKS:

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. RajkumarBuyya,JamesBroberg,AndrzejGoscinski,"CloudComputingPri nciples and Paradigms", John Wiley & Sons, Inc Publications,2011

REFERENCES:

1. Kai Hwang, Fox and Dongarra, Morgan Kaufmann, "Distributed andCloudComputing", 1st Edition, Elseiver,2012.
2. ScottGranneman,"GoogleAppsDeciphered:Computeinthecloudto streamline your desktop", Pearson Education,2009.
3. Tim Malhar, S.Kumaraswammy, S.Latif, "Cloud Security & Privacy",SPD, O"REILLY2009.

OUTCOMES:

- Discuss the core concepts of cloud computing paradigm.
- Analyze services, systems, platforms, frameworks to support cloud computing.
- Illustrate the concepts of cloud storage system services.
- Assess virtualization technology services in open source cloud computing environment.
- Understand data center technology from industry centric perspective.
- Identify cloud security issues to demonstrate real time applications.

ITC3213 DISTRIBUTEDCOMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Tounderstandthecomponents and types of distributed systems.
- Togiveinsightintothebasicprinciplesofhowdistributedcomputersystems areworking.
- Toprovideknowledgeandskillsindesign and development of distributed computingsystems.

MODULE I TYPESOFDISTRIBUTEDSYSTEMS 8

Introduction - Goals - hardware concepts - bus based multiprocessor - switchedmultiprocessor-busbasedmulticomputer-switchedmulticomputer - softwareconcepts-networkoperatingsystems-Multiprocessortimesharing system-True distributed system- Design issues.

MODULE II COMMUNICATIONS 7

Communication-Layered Protocols-Issues incommunications-Client server model-remoteprocedurecall-groupcommunication.

MODULE III S Y N C H R O N I Z A T I O N 8

Synchronization-ClockSynchronization-MutualExclusion-ElectionAlgorithms - Atomictransactions.

MODULE IV S C H E D U L I N G 7

Deadlock-Systemmodels-Processor Allocation– Scheduling.

MODULE V DISTRIBUTEDFILESYSTEMS 8

IntroductiontoDistributedfilesystems-Distributedfilesystemdesign– implementation–filemodels–faulttolerance–filereplication.

MODULE VI DISTRIBUTEDSHAREDMEMORY 7

Consistency models–pagebaseddistributed sharedmemory-sharedvariabledistributedsharedmemory– Case studies.

Total Hours: 45

TEXTBOOK:

1. AndrewS. Tanenbaum,“DistributedOperatingSystems”,PearsonEducationAsia,2001.

REFERENCES:

2. MukeshsinghalandNiranjanG. Shivaratri,“AdvancedconceptsinOperatingSystem”,TataMcGrawHill,2001.
3. Pradeep.KandSinha,“Distributedoperatingsystems”,PHI,2001.

OUTCOMES:

Thestudentscompletingthecourseareexpectedtopossessthefollowing skillsandabilities:

- Understand and be familiar with hardware and software concepts of the distributed operating systems.
- Describe the models and solve the issues associated with the design
- of distributed systems.
- Implement efficient algorithms for distributed computing application.
- Design and implement scheduling algorithms in distributed application.
- Gain the understanding of distributed file system
- Discuss the different types of shared memory distributed systems

ITC3214 OPEN SOURCE TECHNOLOGIES(LABORATORY)

L	T	P	C
1	0	2	2

OBJECTIVES:

- To help demystify the tools in Open source technologies.
- To explain the impact of open source technology in programming.
- To expose students to open source environment and introduce them to use open source Packages.
- To develop GUI processing using Python and PHP.
- To create back end server using MySQL.

LIST OF EXERCISES:

1. Case study: Proprietary Vs Open Source tools
2. Deploy a LAMP stack in Linux
3. Create an application that uses all the LAMP stack components
4. OPEN SOURCE TOOLS AND TECHNOLOGIES: WEB SERVER: Apache Web server –Working with Web server –Configuring and using Apache Web services –Execution Environment
5. Open Source Software tools and processors –Eclipse IDE platform – Compilers.
6. Creation of Simple application using GIMP tool.
7. Demonstration of GitHub.
8. OPEN SOURCE PROGRAMMING LANGUAGES: PHP: Introduction-Programming in Web Environment and SQL database.
9. OPEN SOURCE PROGRAMMING LANGUAGES: PYTHON: Python objects-Numbers-Sequences-Strings-Lists and Tuples -Dictionaries-Conditionals and loops
10. OPEN SOURCE DATABASE: MySQL: Introduction-Setting up account-Starting, terminating and writing your own SQL programs ,MySQL and Web.

Total Hours : 45

OUTCOMES:

Students who complete this course will be able to:

- Analyze the difference between the open source model and commercial proprietary model.
- Expertise on using a variety of open source software.
- Develop and deploy a project based purely on open source tools.

ITC3215	SOFTWARE DEVELOPMENT LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- Createaprojectteamandappointaprojectleader.
- Assumetheroleofclient. discuss,evaluateandproposetherequirementsfora real-worldproblem.
- Discuss the software requirement with teamlead.
- Use the template to writerequirements.
- To take part in ongoing project development process such asrequirementanalysis, design, implementation andtesting.
- Learn where and how to make improvements in the softwaredevelopmentprocess through developingprojects.

LIST OFEXERCISES

Note: Listofexerciseswillbeframedbasedontheprofessionalelectivechosen.

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

Total Hours : 45

OUTCOMES:

- Discuss, evaluate and propose the requirements to solve real world problem with team members.
- Analyze software requirements and prepare software design using common template.
- Implement and test software module in coordination with other team members.

SEMESTER VII

ITC4101	INTERNET OF THINGS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To introduce the basics of Internet of things.
- Utilize IoT features and create applications based on IoT protocols.
- To discuss the features of cloud of things and web of things.
- Outline the embedded prototyping and design and apply the use of Devices in IoT Technology.
- To explain Real World IoT Design and compile the same.

MODULE I INTRODUCTION 8

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT – The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT.

MODULE II IOT PROTOCOLS 8

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 8

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 7

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 7

Prototyping embedded devices – Electronics- Sensors – Actuators – Arduino –

Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE VI PROTOTYPING ONLINE COMPONENTS AND EMBEDDED CODING **8**

Sketch – Iterate and Explore – Preparation of physical prototype – Getting started with API – Writing New API – Writing New API – Real Time Reactions – Other Protocols – Techniques for Writing Embedded code –Memory Management – Performance and Battery Life – Libraries and Debugging.

Total Hours : 45

LAB COMPONENT - LIST OFEXERCISES

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

Practical: 30 Hours

T: 45, P: 30, Total: 75 Hours

REFERENCES:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles, Architecting the Internet of Things, Springer, 2011.
3. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, Jhon Wiley and sons, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

OUTCOMES:

Upon Completion of course the students will be able to:

- Identify and design the new models for market strategic interaction
- Analyze various protocols for IoT
- Analyze and compare Cloud of things and Web of things
- Design a middleware for IoT
- Identify the prototyping with various embedded devices
- Analyze and design different models for embedded devices and API techniques

ITC4102 INFORMATIONSECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of cryptography techniques.
- To explore the technological aspects of program and web security.
- To know the security mechanism given by operating system.
- To discover the network level security.
- To study the critical need for ensuring Information Security in database.
- To know the legal, ethical and professional issues in Information Security.

MODULE I CRYPTOGRAPHY 9

Introduction - Computer Security – Threats - Harm – Vulnerabilities – Controls - Authentication - Access Control – Cryptography – Symmetric key & Asymmetric key encryption – Digital signatures.

MODULE II PROGRAM& WEB SECURITY 7

Unintentional (Nonmalicious) Programming errors – Malicious code – Malware - Viruses, Trojan Horses, and Worms – Countermeasures - The Web - Browser Attacks - Web Attacks Targeting Users - Email Attacks.

MODULE III OPERATINGSYSTEM SECURITY 7

Memory and Address Protection - File Protection Mechanisms -User Authentication - Trusted Operating Systems - Designing TrustedOperatingSystems- Assurance in Trusted OperatingSystems

MODULE IV NETWORKSECURITY 8

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

MODULE V DATABASE SECURITY 7

Introduction - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data

MODULE VI ADMINSTERING SECURITY AND ETHICAL ISSUES 7

SecurityPlanning-RiskAnalysis-OrganizationalSecurityPolicies-PhysicalSecurity-ProtectingProgramsandData-InformationandtheLaw-Computer Crime - EthicalIssues.

Total Hours : 45

TEXT BOOK:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th Edition,PearsonEducation,2015.

REFERENCES:

1. WilliamStallings,"CryptographyandNetworkSecurity-Principlesand Practices", 3rd Edition, Pearson Education,2003.
2. AtulKahate,"CryptographyandNetworkSecurity",TataMcGrawHill,2003.

OUTCOMES:

- Analyze the various cryptographic techniques in Information Security.
- Identify program level malicious code and provide control measures.
- Discuss operating system level security to assess trusted operating systems.
- Explain threats in network level scenarios.
- Outline database security requirements in multilevel databases.
- Discuss organizational security policies and ethical issues.

ITC4103 WIRELESSNETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn the fundamental concepts of wireless, mobile and personal telecommunication system.
- To understand the wireless network topologies, cellular concepts and its operational characteristics.
- To explain the evolution of WLAN and the channel access mechanisms.
- To gain knowledge about the different routing protocols in adhoc wireless networks.
- To understand WPAN and geo-location systems.

MODULE I PHYSICAL LAYER ALTERNATIVES FORWIRELESS NETWORKS 8

Applied Wireless Transmission Techniques. Short DistanceBaseband Transmission.PulseTransmission.CarrierModulatedTransmission.TraditionalDigitalCellularTransmission.BroadbandModemsforHigherSpeeds.SpreadSpectrum Transmissions. High-Speed Modems for SpreadSpectrumTechnology. Diversity and Smart Receiving Techniques. Comparisonof Modulation Schemes. Coding Techniques for WirelessCommunications

MODULE II PRINCIPLES OF WIRELESS NETWORK OPERATION 8

Wireless networks topologies, cellular topology, cell fundamentals signaltointerferenceratiocalculation,capacityexpansiontechniques,cellsplitting,use of directional antennas for cell sectoring, micro cell method, overloadcells,channelsallocationtechniquesandcapacityexpansionFCA,channelborrowingtechniques, DCA, mobility management, radio resources andpower management securities in wirelessnetworks.

MODULE III GSM, CDMA AND TDMA TECHNOLOGY 8

Mechanism to support a mobile environment, communication in the infrastructure, IS-95 CDMA forward channel, IS - 95 CDMA reverse channel, pallet and frame formats in IS - 95; forward channel in W-CDMA and CDMA 2000, reverse channels in W-CDMA and CDMA 2000.

MODULE IV LOCAL BROADBANDNETWORKS 7

HistoricaloverviewsoftheLANindustry,evolutionoftheWLANindustry,wirelesshomenetworking,IEEE802.11, PhysicalLayer,BasicMACLayerMechanisms, CSMA/CAMechanisms,otherMACLayersfunctionalities.

MODULE V AD HOCNETWORKS 7

OverviewsofAdhocnetworks,IssuesinDesigningaRoutingProtocolforAdHocWireless Networks,ClassificationsofRoutingProtocols,Proactive,Reactive and Hybrid routing protocols - DSDV, AODV, DSR, ABR,TORA,ZRP.

MODULE VI WPAN AND GEOLOCATIONSYSTEMS 7

IEEE 802.15 WPAN, Home RF, Bluetooth, interface between Bluetoothand802.11,wirelessgeolocationtechnologiesforwirelessgeolocation,geolocation standards for E.911service.

Total Hours : 45

TEXTBOOK:

1.KavehPahlavan,PrashantKrishnamoorthy,"PrinciplesofWirelessNetworks-Aunitedapproach",PearsonEducation,2008.

REFERENCES:

1. Jochen Schiller, "Mobile Communications", 2nd Edition, PearsonEducation,2003.
2. X.Wang and H.V. Poor, "Wireless Communication Systems", Pearson education,2004.
3. M.Mallick,"MobileandWirelessdesignessentials",WileyPublishingInc.2003.
4. P. Nicopolitidis, M.S. Obaidat, G.I. papadimitria, A.S. Pomportsis,"Wireless Networks", John Wiley & Sons,2003.

OUTCOMES:

- Explain the various wireless transmission and coding techniques.
- Discuss the principle of operation of wireless networks and its issues.
- Analyze the IEEE802.11,ITU,andIS-Xstandardsformultipleaccesswirelessnetworks.
- Discuss about the application of wireless technology in real world applications.
- Compare the different routing protocols for adhoc networks.
- Analyze the available commercial implementations of severalwirelesstechnologies.

ITC4104 PROGRAMMING IN HADOOP(LABORATORY)

L	T	P	C
0	0	3	1

OBJECTIVES:

- To make the students familiar with Hadoop distributed file system and can learn how to configure Hadoop.
- To create single node and multinode using Hadoop and to learn programming using Map Reduce paradigm.
- To provide a complete knowledge about Hadoop echo system with key components like Pig, Hive and Sqoop.
- To Install Apache Spark and explore the components in it

List of exercises:

1. Introduction to HDFS and Hadoop Ecosystem. Configuration and Installation of Hadoop 1.0 Single node with Name node and Data node.
2. Configuration of Hadoop 1.0 with SSH key for security for Name and Data Node with Demo of Pseudo distributed Node and Case Study of Multinode set up.
3. Study of Map reduce Java API. Simple programs in Map Reduce paradigm with java concepts.
4. Working on Input functions, mapper & reducer functions. Simple program for text extraction and title extraction.
5. Program for searching key word and extract it from the given text paragraph.
6. Program for extracting link from a HTML page using Map and Reduce.
7. Implementation of Pig using Hadoop Ecosystem for processing structured Data.
8. Implementation of Sqoop for transferring schema format to NOSQL format.
9. Implementation and configuration of Hive in Hadoop ecosystem for querying.
10. Apache Spark Installation and implementation of simple programs in it.

Total Hours: 45

OUTCOMES:

Upon Completion of this course the student will be able to

- Demonstrate single node and multinode Hadoop 1.0 with installation and configuration.

- Compute simple programs in Hadoop using Map reduce Paradigm.
- Analyze Hadoop Ecosystem using simple components like Pig, Hive and Sqoop.
- Exploring Apache Spark and analyzing the components in it.

Programme Elective – I
Semester – IV

		L	T	P	C
ITCX201	**ANDROID APPLICATION DEVELOPMENT(LABORATORY)**	**1**	**0**	**2**	**2**

OBJECTIVES:

- To know the importance of mobile applications.
- To learn the fundamentals of Android application development.
- To develop simple mobile applications using Android.

THEORETICAL STUDY

ANDROID APPLICATION DEVELOPMENT **15**

Android Basics - Android Architecture - Application Framework - The Manifest file - Libraries – Developing - Managing Virtual Devices - Building and Running – Debugging – Testing - Building Blocks - Application Components - Content Providers - Broadcast Receiver - Processes and Threads - Data storage - SQLite Databases - Localization - User Interface.

LABORATORY PRACTICE **30**

- Developing Simple Android Applications (4 exercises)
- Mobile application development in Android. (Students can select their own problem to develop an Application)
  Sample applications
  - Scientific calculator
  - Online shopping
  - Student attendance and marks maintenance
  - Bus route management
  - Games

Total Hours: 45

REFERENCES:

1. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, O'Reilly Media, 2015.
2. John Horton, “Android Programming for Beginners”, Packt Publishing,

2015.
3. Herbert Shieldt, “Java: A Beginner's Guide”, 7th Edition, Oracle Press, 2017.

OUTCOMES:

On completion of the course students will be able to:

- Describe the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- Apply the different types of application models/architectures used to develop mobile software applications.
- 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.
- Work within the capabilities and limitations of a range of mobile computing devices.
- Design, implement and deploy mobile applications using an appropriate software development environment.

ITCX202 NEXTGEN TECHNOLOGIES L T P C

3 0 0 3

OBJECTIVES:

- To understand the fundamentalconcepts of Next Generation Technologies like Cloud, Big Data, IoT and Social Media and Mobility, Machine learning, Artificial Intelligence and their impact on the industry.
- To 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.
- To learn the concepts of social media and how social Media is used for business
- To understand the development of various mobile platforms, mobile apps and their operating systems.
- To discuss IoT, IPV6, and future of IoT and its uses across various industries.
- To acquire knowledge of AI – Machine Learning Algorithms and uses of AI in the various industries.

Prerequisites: Programming in Python, Java Programming, Computer Programming

MODULE I INTRODUCTION TO NEXT GENERATION TECHNOLOGIES 7

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 7

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.

MODULE IV MOBILE APP DEVELOPMENT 7

Introduction – Mobile Platforms - Andriod Development Environment – XCode, Eclipse, VS2012, PhoneGAP - Multichannel and Multimodel UIs – App store, Google Play, Windows Store - Mobile device application programming interfaces – Android/iOS/Win 8 Survial and basic apps – Impact on business cases.

MODULE V INTERNET OF THINGS (IOT) 8

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 VI ARTIFICIAL INTELLIGENCE & MACHINE LEARNING 8

Foundations of AI & Machine Learning – Knowledge representation – Advanced search – Types of learning – Supervised – Unsupervised – Dimensionality Reduction – Machine Learning System Design – 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

Total Hours : 45

TEXT BOOKS:

1. Ian Foster, Dennis B.Gannon, “Cloud Computing for Science and Engineering”, MIT Press, September 2017.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, John Wiley & Sons, Inc., Publications, 2011.
3. Michael Minelli, Michele Chambers, Ambiga Dhiraj., “Big Data, Big Analytics, Emerging Business Intelligence and Analytic Trends for Today's Businesses”, First Edition, Wiley Publications, 2013.
4. Luttrell, Regina, “Social Media: How to Engage, Share, and Connect”, Rowman

& Littlefield Publishers, 2016.
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.

REFERENCE BOOKS:

1. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
2. Matt Neuburg, “Programming iOS 5”, O'Reilly Media, Inc., 2012.
3. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, John Wiley and Sons, 2014.
4. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.

OUTCOMES:

- Describe the concepts of Next Generation Technologies.
- Understand cloud services, Big Data, Data science, Hadoop, and their impact on industry.
- Analyze social media and impact of social media on the business.
- Understand any of the mobile platforms, and mobile programming language.
- Develop skills on IoT technologies and their contact on industry.
- Implement AI & machine learning algorithms for an application and analyze the results.

ITCX203	MULTIMEDIA TOOLS AND TECHNIQUES(LABORATORY)	L	T	P	C
		0	0	3	1

OBJECTIVES:

To enable the students to

- understand and gain knowledge about the various multimedia tools.
- learn to do Image Editing using Adobe Photoshop.
- design animation using Adobe Flash, Write Action script.
- edit text, image, audio and video

LIST OF EXERCISES

1. Create an image and demonstrate basic image editing using photoshop
2. Demonstrate rasterization and filtering of layers, blending effects, text effects using photoshop
3. Design logo using adobe illustrator
4. Create animated text effects and transition using flash.
5. Create an advertisement using guide layer, masking, morphing, and onion skin in flash
6. Generate frame by frame animation using multimedia flash
7. Create 2D/3D Animation using Flash/ Director
8. Create 3D Animation using 3dsmax/Maya
9. Editing Audio and Video

Total Hours : 45

OUTCOMES:

After successful completion of this course, the students should be able to

- design and implement an animation for various themes.
- create multimedia advertisement.
- edit audio and video using multimedia tools.

ITCX204 SYSTEMSOFTWARE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- study about assemblers and macroprocessor.
- analyze about linkers and loaders.
- demonstrate the concept about emulators.
- learn about the tools used for system software.

Prerequisite: To understand about assembly language programming.

MODULE I INTRODUCTION 8

Simplified Instructional Computer (SIC)--Modes of addressing - instruction sets,instruction formats - I/O instructions-Device Driver, Role of Device Drivers, Classes of Devices, Security issues, Design issues.

MODULE II ASSEMBLERS 8

Definition- Machine dependent features –Types of addressing modes and types of instruction formats - Programrelocation– Assembler machine independent features – Literal pool- Statements defining symbols - Expressions– Types of assemblers– example of a assembler.

MODULE III LOADERS ANDLINKERS 8

Absolute Loader - Features of Loader- Machinedependent and machine independent-Program relocation ,linking- Tables used duringLinking– Standard LibrarySearch- Design of Loader-LinkageEditors–Dynamic programLinking– Types of Loaders-MSDOSlinker.

MODULE IV MACROPROCESSORS AND EMULATORS 8

Functions of a macro processor - Macro Definition and Expansion – Tables generated- machine-independentfeatures - Example-MASMMacroProcessor-Introduction of virtual machine (VM)-Emulation –Basic interpretation-Threaded interpretation.-Binary Transalation.

MODULE V COMPILER ANDINTERPRETERS 8

BasicconceptsofCompiler-PhasesofCompiler-Interpreters-BenefitsofInterpreters-Overview of Interpretation-A Toy Interpreter-Pure andImpureInterpreters.

MODULE VI TEXT EDITOR 5

Features of a Texteditors- Editing tasks -EditorStructure- DebuggingSystems-Debugging tasks - User-InterfaceCriteria.Android operatingsystem: Android Architecture, Linux Kernel, Android Architecture Libraries, Android Architecture Application Framework, Applications, Security features and Permission.

Total: 45 Hours

TEXTBOOK:

1. LelandL.Beck,"SystemSoftware-AnIntroductiontoSystemsProgramming",3rdEdition,PearsonEducationAsia,2000.

REFERENCES:

1. D.M.Dhamdhere,"SystemsProgrammingandOperatingSystems",2nd Edition,TataMcGraw-Hill,1999.
2. JohnJ.Donovan,"SystemsProgramming",TataMcGraw-Hill,1972.
3. Neil Smith , ”Android studio development essentials”, Second edition .

OUTCOMES:

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

- Outline the architecture of hypothetical computers.
- Summarize the functions of assembler.
- Discuss about the various loaders and linkers.
- Compare the different types of macroprocessors.
- Outline about compilers and interpreters.
- Design a text editor and analyze its features.

ITCX205 PRINCIPLES OF COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of electronic communication.
- To gain experience about the modulation and demodulation techniques.
- To teach the importance of digital communication.
- To understand the various satellite communication systems.

MODULE I FUNDAMENTALS OF ELECTRONIC COMMUNICATION 8

The Significance of Human Communication - Communication Systems - Types of communication – Modulation and Multiplexing - EM spectrum -Optical spectrum – Bandwidthand Gain – Attenuation and Decibels -Tuned Circuits- Filters - Application.

MODULE II AMPLITUDE MODULATOR AND DEMODULATOR CIRCUITS 8

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 III FREQUENCY MODULATION TECHNIQUE 8

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 IV DIGITAL MODULATION TECHNIQUES 7

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 V SPREAD SPECTRUM TECHNIQUES 7

Introduction, Pseudo noise, properties, model-spread spectrum- performance of DSSS, FHSS - frequency hopping- access techniques–Comparison, Coding of speech for wireless.

MODULE VI SATELLITE COMMUNICATION 7

Satellite systems - Satellite Orbits – Spectrum usage – Satellite sub systems - Communication sub system – Power–Antenna – Receiver– Transmitter – Ground station - Satellite application – Global navigation.

Total Hours : 45

TEXT BOOKS:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th edition Pearson Education, 2014.
2. Louis E. Frenzel Jr., “Principles of Electronic Communication Systems”, 4th Edition McGraw-Hill Education, 2016.

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.

OUTCOMES:

On completion of the course students will be able to:

- Outline the basics of electronic communication.
- Analyze the basic concepts of Frequency Modulation and Phase Modulation.
- Discuss the various Digital modulation techniques.
- Apply suitable modulation schemes and coding for various applications.
- Analyze the various spread spectrum transmission techniques.
- Identify and describe different satellite communication techniques.

ITCX206 PRINICPLES OF COMPILER DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- enrich the knowledge in various phases of compiler.
- design and construct a lexical analyzer.
- expand the knowledge of parser by parsing.
- construct the syntax-directed tress
- concise and design optimization of codes.
- design a compiler for a simple programming language.

Prerequisite: Programming concepts and Data structures

MODULE I INTRODUCTION 7

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 8

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 7

Syntax-Directed Definitions - Construction of Syntax Trees - Syntax-Directed Translation schemes - Implementing L-Attributed SDD's.

MODULE V INTERMEDIATE CODE GENERATION 7

Variants of syntax trees - Three-address code - Types and declarations - Translation of Expressions - Type checking - Type Conversions - Control Flow.

MODULE VI CODE OPTIMIZATION AND CODE GENERATION 7

Issues in design of a code generator - The target language - Addresses in the target code - Flow graphs - Optimization of basic blocks - a simple code generator algorithm - Peephole Optimization - Register Allocation and Assignment - Optimal code generation.

Total : 45 Hours

TEXTBOOK:

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.

OUTCOMES:

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

- obtains the knowledge of modern compiler & its features.
- analyze the given program using lexical analyzer
- discuss various parsing techniques.
- evaluate the syntax directed translation.
- design and conduct experiments for intermediate code generation.
- demonstrate the compilation of a program in a regular high level language.

ITCX207	USER INTERFACE DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to

- gain knowledge on the user interface design process.
- learn business functions and to understand the user interface design principles.
- Be familiar on menus and windows.
- Understand hoe to use messages and controls.
- acquire the knowledge about icons and images.
- learn about android.

Prerequisite: Computer Fundamentals

MODULE I DESIGN PROCESS 8

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 7

Know Your User or Client - Understand the Business Function - Understand the Principles of Good Interface and Screen Design

MODULE III MENUS AND WINDOWS 8

Develop System Menus and Navigation Schemes - Select the Proper Kinds of Windows -

MODULE IV CONTROLS AND MESSAGES 7

Screen-Based Controls - Text and Messages - Effective Feedback and Guidance and Assistance - Internationalization and Accessibility -

MODULE V VISUAL OBJECTS & TESTING 7

Meaningful Graphics, Icons, and Images - Proper Colors - Test, Test, and Retest

MODULE VI ANDROID USER INTERFACE DESIGN 8

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

Total : 45 Hours

TEXTBOOK:

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

OUTCOMES:

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

- explain the design process.
- apply the design principles to develop a good user interface design.
- design a software with suitable types of menus and windows.
- develop appropriate message windows and text messages.
- choose meaningful icons and colors.
- Develop android applications.

ITCX208 SEMANTIC WEB

L	T	P	C
2	0	0	2

OBJECTIVES:

To enable the students to

- To understand the evolution and significance of semantic web.
- To identify and explore tools and methods to construct and implement ontologies.
- To build and implement a micro level ontology that is semantically descriptive of chosen problem domain.
- To develop and implement applications and tools based on ontology.

Prerequisite: Web Technology, Internet Technology Fundamentals.

MODULE I INTRODUCTION TO SEMANTIC WEB 9

Overview of semantic web – source of semantic web– examining semantic web and examples-semantic wikis-twine-FOAF project-sources of semantic data-RDF-architecture of semantic web-role of ontology in sematic web-semantic web data-Compare and Contrast semantic technologies with traditional technologies-Semantic framework-web based issues and solutions.

MODULE II ONTOLOGY & WEB RESOURCES 12

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies - Kind of Ontology resources -construction of ontology instances – Classifications and methods for building ontology -Ontology Development Life Cycle & process – Ontology-Evolution – Versioning-Structured Web Documents - XML ,JSON– Building page structures – Namespaces – Labeling – Query parsers for ontology– RDF – RDF based models– Formats - RDF grammar– fundamentals.

MODULE III SEMANTIC WEB TOOLS AND APPLICATIONS 9

Tools for construction and designing ontology and reasoning logics for semantic web– Apache Jena Framework, Protégé – SPARQL – Alchemy API – Word Net based Applications -Case studies and Applications using Python and NLTK based Libraries.

Total : 30 Hours

TEXTBOOK:

1. Liyang Yu, A Developer's Guide to the Semantic Web, Springer; 3rd Edition, 2015.

REFERENCES:

1. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, Semantic Web
2. Programming, Wiley; 1 edition, 2009.
3. Grigoris Antoniou, Frank van Harmelen, A Semantic Web Primer, Second Edition
   (Cooperative Information Systems) (Hardcover), MIT Press, 2008
4. Dean Allemang and James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2 edition, 2011.

OUTCOMES:

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

- Explore fundamentals of semantic web, models and tools.
- Understand semantic tools and techniques for representing ontology as XML and RDF files.
- Have hands on experience on various popular Semantic NLP tools and libraries.

PROGRAMME ELECTIVE – II (6 Credits)

ITCX101	iOS APPLICATION DEVELOPMENT(LABORATORY)	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To know the fundamentals of iOS programming using Swift.
- To create swift programs in Xcode IDE.
- To develop simple iOS mobile applications.

THEORETICAL STUDY

iOS APPLICATION DEVELOPMENT **15**

iOS Basics - iOS Architecture - Integrated development Tools - Swift - Frame work and Libraries - Project templates - Resource & Application Settings - Views & Controls - Debugging & Running - Building Block Approach - Application Life cycle - MVC – Pattern - View - Data Management - Core Data - Application Storage - External 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)

  Sample applications
  - Scientific calculator
  - Home Automation
  - Ecommerce App
  - Currency converter
  - Reminder
  - Games

Total Hours : 45

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. Rob Napier, Mugunth kumar, “iOS 7 Programming”, Wiley, 2014.
4. Erica Sadun, “The iOS 5 Developer’s Cookbook”, Pearson, Third Edition, 2012.

OUTCOMES:

On completion of the course students will be able to :

- Describe the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- Apply the different types of application models/architectures used to develop mobile software applications.
- Describe the components and structure of an integrated development environment (XCode) and learn how and when to apply the different components to develop a working system.
- Work within the capabilities and limitations of a range of mobile computing devices.
- Design, implement and deploy mobile applications using an appropriate software development environment.

ITCX102	ORACLE DATABASE PROGRAMMING(LABORATORY)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To design and implement effective SQL queries within database applications and manipulate database data effectively.
- To demonstrate a database solution for a business or organization using Oracle Application Express (APEX).
- To implement database-driven web site with database programming with PL/SQL.
- To develop, execute and manage PL/SQL database program like procedures, functions, and database triggers.

LIST OFEXERCISES:

1. Design of database with SQL using DDL, DML, and TCL commands.
2. Implementation of Single Row Functions, JOINs, Group Functions.
3. Implementation of Constraints, Views, Sequences, Privileges and Regular Expressions.
4. SQL Functions, Triggers and Procedures.
5. Database and Websheet application creation in Oracle Application Express (APEX) using Application Builder.
6. Working on SQL Commands in Oracle Application Express - SQL Command Processor.
7. Transferring Schema and Data in APEX.
8. Database Programming with PL/SQL
    - Retrieving & Manipulating Data in PL/SQL
    - Using Explicit & Multiple Cursors
    - Program Structures to Control Execution Flow
    - Creating procedures and Passing parameters
    - Using dynamic SQL
    - Database Event Triggers
9. Design and Implement a basic database using the Oracle Database Management and Java Programming.
10. Creating and Presenting Database Projects.

Total Hours : 30

OUTCOMES:

- Understand the use and application of the relational database model.
- Enhance skills in Oracle database programming.
- Implement database applications using Java programming.
- Design database and web sheet application creation using ApplicationBuilder.
- Expertise in relational database data management.

ITCX103 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the techniques in natural language processing.
- Be familiar with the natural language generation.
- Be exposed to machine translation.
- Understand the information retrieval techniques.

MODULE I OVERVIEW AND LANGUAGE MODELING 7

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 7

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 8

Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing. Semantic Analysis: Meaning Representation-Lexical Semantics-Ambiguity-Word Sense Disambiguation.

MODULE IV DISCOURSE PROCESSING AND NATURAL LANGUAGE GENERATION 8

Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure. Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG.

MODULE V MACHINE TRANSLATION AND INFORMATION RETRIEVAL 8

Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

MODULE VI LEXICAL RESOURCES AND APPLICATIONS 7

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.

Total Hours : 45

REFERENCES:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. 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.
3. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin Cummings publishing company, 1995.

OUTCOMES:

Upon completion of the course, the student should be able to:

- Discuss the major trends and systems in Natural Language Processing.
- Explain context free grammars and the use of parsers.
- Outline the syntax of grammars and analyze the feature-based semantic systems.
- Apply statistical techniques to natural language analysis.
- Do machine translation.
- Apply information retrieval techniques.

ITCX104 **GAME THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory.
- Appraise theoretical predictions obtained from Game Theory analyses against real world conflicts.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.
- Integrate increasing analytical skills into increasingly complex conflicts.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.

MODULE I GRAPHICS SYSTEM FOR GAME THEORY 7

Coordinate Systems - Handedness and Cross Products - Points and Vectors – Transformations – Cameras - Culling and Clipping – Rasterizing - Vertex Attributes – Rendering.

MODULE II GAME DESIGN & GAME PROGRAMMING 8

Game Design - Game Writing - Narrative Theory - Story and Character Development - Game play - Creating the Game World - Level Design Human - Computer Interface design - Game Programming Fundamentals - C++ - Java - Scripting Languages.

MODULE III GAMES WITH PERFECT & IMPERFECT INFORMATION 8

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies - Nash equilibrium - mixed strategy equilibrium – zero sum games - Games with Imperfect Information – Bayesian Games - Extensive Games with Imperfect – Information – Strategies - Beliefs and sequential equilibrium – Illustrations - Repeated Games – The Prisoner's Dilemma – Bargaining.

MODULE IV NON - COOPERATIVE GAME THEORY 7

Non-cooperative Game Theory – Self - interested agents - Games in normal form - Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal - Form Games - Computing Nash equilibrium of two - player, zero - sum games - Computing Nash equilibrium of two - player, general - sum games - Identifying dominated strategies.

MODULE V MECHANISM DESIGN 8

Aggregating Preferences - Social Choice - Formal Model – Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences - Efficient mechanisms - Vickrey and VCG mechanisms (shortest paths) - profit maximization Computational applications of mechanism design - applications in Computer Science - Google's sponsored search - eBay auctions.

MODULE VI GAME PRODUCTION AND BUSINESS OF GAMES 7

Game production - Project management - Game industry roles – Economics – Publisher - Developer relationship – Marketing - Intellectual Property rights - Content regulation.

Total Hours : 45

TEXT BOOKS:

1. M. J. Osborne, “An Introduction to Game Theory”. Oxford University Press, 2004.
2. David H. Eberly, —3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics‖, Second Edition, Morgan Kaufmann, 2010.

REFERENCES:

1. Jonathan S. Harbour, —Beginning Game Programming‖, Course Technology, Third Edition PTR, 2009.
2. Ernest Adams and Andrew Rollings, —Fundamentals of Game Design‖, Third Edition, Pearson Education, 2014.
3. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, —Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer‖, First Edition, Wiley, 2008.

4. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, “Algorithmic Game Theory”, Cambridge University Press, 2007.

OUTCOMES:

- Discuss the notion of a strategic game and equilibrium, and identify the characteristics of main applications of these concepts.
- Communicate game - theoretic ideas and concepts to non - specialist audiences in a language which is accessible and comprehensible.
- Discuss the game with perfect and imperfect information with the use of Nash Equilibrium for other problems.
- Model competitive real world phenomena using concepts from non-cooperative game theory.
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
- Implement a typical Virtual Business scenario using Game theory applications.

ITCX105 SOFTCOMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the basic concepts of soft computing
- TobecomefamiliarwithAIandneuralnetworksthatcanlearnfromavailableexamplesandgeneralizetoformappropriaterulesforinferencingsystems.
- Provide the mathematical background for carrying out theoptimization associated with neural networklearning.
- Develop the case studies utilizing the above and illustrate the intelligent behavior of programs based on Fuzzy logic
- Introducing the basic ideas of Machine learning.
- Familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

MODULE I INTRODUCTION **8**

Introduction of soft computing, soft computing vs. hard computing,varioustypes of soft computing techniques, applications of soft computing.ArtificialIntelligence:Introduction to searching: breadth first search, depth first searchtechniques,other Search Techniques like hill Climbing, A*algorithm,AO* Algorithms and various types of control strategies.Knowledge representationissues,Prepositionalandpredicatelogic,monotonicandnonmonotonicreasoning,forwardReasoning,backwardreasoning.

MODULE II INTRODUCTION TO NEURALNETWORK **8**

StructureandFunctionofasingleneuron:Biologicalneuron,artificialneuron,definitionofANN,TaxonomyofneuralnetDifferencebetweenANNandhuman brain,characteristicsandapplicationsofANN,singlelayernetwork,Perceptron training algorithm, Linear separability, Widrow & Hebb"s learningrule/Delta rule,ADALINE,MADALINE,AIv/sANN.

MODULE III MLP **7**

Introduction of MLP, different activation functions, Error backpropagation algorithm,derivationofBBPA,momentum,limitation,characteristicsandapplicationofEBPA.Counterpropagationnetwork,architecture,functioning&characteristicsofcounte

rPropagationnetwork,Hopfield/Recurrentnetwork, associative memory, andcharacteristics,limitationsandapplications.

MODULE IV FUZZYLOGIC 8

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

MODULE V MACHINE LEARNING 7

Learning form Examples - Inductive Concept Learning - Sequence Prediction - Effect of Noise in Input. Learning by Analogy- Concept formation - Derivational Analogy. Learning by Observation and Discovery - Search for Regularity- Conceptual Clustering, Computational Learning Theory.

MODULE VI GENETICALGORITHM 7

Fundamentals,basicconcepts,workingprinciple,encoding,fitnessfunction,Geneticm odeling:Inheritanceoperator,crossover,inversion&deletion,mutationoperator,Bitwise operator,constraints ,GenerationalCycle,Real Applications&advancesinGA.

Total Hours : 45

TEXT BOOKS:

1. S.Rajasekaran &G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic &Genetic Algorithms,Synthesis&applications”,PHIPublication,2002.
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.
3. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.

REFERENCES:

1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”,McGraw-Hill,1997.
2. N.K.Bose,“NeuralNetworkFundamentalswithGraphs,Algorithms,andAppli cations” TMH,1996.
3. Kosko:“NeuralNetwork&FuzzySystem”,PHIPublication,1992.

4. RichEandKnightK,“ArtificialIntelligence”,TMH,1991.
5. Tom. M Mitchell, McGraw Hill International Edition.

OUTCOMES:

At the end of the course the student should be able to;

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures
- Understand perceptrons and counter propagation networks.
- Define the fuzzy systems
- Familiar with the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.
- Analyze the genetic algorithms and their applications

ITCX106 MACHINE LEARNING ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students

- To study the components, models of machine learning.
- To discuss the various concepts related to supervised and unsupervised learning.
- To recognize the different types of machine learning models and how to use them.
- To learn the theoretical and practical aspects of tree and graph models.
- To acquire the knowledge of reinforcement learning.
- To discuss various applications in machine learning.

MODULE I INTRODUCTION TO MACHINE LEARNING 7

Introduction - Component of learning - examples of machine learning applications - Types of machine learning - Mathematical foundations of machine learning - Learning models - Probabilistic models - Logic models - Parametric Models - Non-Parametric Models - Theory of learning - Theory of generalization.

MODULE II SUPERVISED LEARNING 8

Linear classification - Linear Models for Regression – Univariate linear regression Multivariate linear regression - Bayesian Linear Regression – Linear algebra review - Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models -Probabilistic Discriminative Models. Learning Artificial Neural Networks - Feed-forward Network Functions - Back Propagation Network - Bayesian Neural Network - support vector machines - Ensemble methods.

MODULE III UNSUPERVISED LEARNING 8

Nearest neighbor models – Clustering - K-means - hierarchical clustering - k-d trees - EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis - Principal Component Analysis (PCA) - Probabilistic PCA - Independent components analysis (ICA) - Singular Value Decomposition - meta learning.

MODULE IV TREE AND GRAPHICAL MODELS 8

Decision trees - learning decision trees - regression trees - clustering trees - descriptive rule learning - association rule mining - Graphical Models - Undirected

graphical models - Markov Random Fields - Directed Graphical Models - Bayesian Networks - Inference - Learning - Generalization - Hidden Markov Models.

MODULE V REINFORCEMENT LEARNING 7

Passive reinforcement learning - direct utility estimation - adaptive dynamic programming - temporal-difference learning - active reinforcement learning - exploration - learning an action-utility function - Generalization in reinforcement learning - policy search - applications in game playing - applications in robot control.

MODULE VI APPLICATIONS 7

Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks - Case Study - Octave/Matlab.

Total Hours : 45

TEXT BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, MIT Press, 2014.
2. Alex Smola and S.V.N Vishwanathan, “Introduction to Machine Learning”, Second Edition Cambridge University Press, 2010.

REFERENCES:

1. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
2. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
3. Ian H. Witten, Eibe Frank, Mark A. Hall, “Data Mining: Practical MachineLearning Tools and Techniques”, Third Edition, Morgan Kaufmann, 2011.
4. T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.

OUTCOMES:

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

- Describe the concepts, components and models of machine learning.
- Understand and design algorithms for supervised and

unsupervisedlearning.

- Develop skills by using unsupervised learning techniques.
- Analyze the efficient tree and graphical models for solving real world problems.
- Implement reinforcement learning algorithms for anapplication and analyze the results.
- Apply the appropriate techniques in social network analysis and web security.

ITCX107 C# AND .NET FRAMEWORK L T P C
3 0 2 4

OBJECTIVES:

The student should be made to:

- Understand the foundations of CLR execution.
- Know the object oriented aspects of C#.
- Learn the technologies of the .NET framework.
- Be aware of application development in .NET.
- Learn web based applications on .NET (ASP.NET).

MODULE I INTRODUCTION TO C# 8

Review of OOP Concepts - Overview of .NET Framework - Basic Elements of C# - Program Structure and simple Input and Output Operations – Operators and Expressions – Statements – Arrays and Structures.

MODULE II OBJECT ORIENTED ASPECTS OF C# 8

Inheritance - Namespace – Polymorphism – Interface and Overloading – Multiple Inheritance – Property – Indexes – Delegates – Publish/Subscribe Design Patterns-Operator Overloading-Method Overloading

MODULE III C# CONCEPTS FORFILES AND THREADS 8

C# Concepts for creating Data Structures - File Operation – File Management systems–

Stream Oriented Operations- Multitasking – Multithreading – Thread Operation – Synchronization.

MODULE IV XML and .NET 7

Working with XML – Techniques for Reading and Writing XML Data - Using XPath andSearch XML - ADO.NET Architecture – ADO.NET Connected and DisconnectedModels– XML and ADO.NET – Simple and Complex Data Binding– Data Grid View Class.

MODULE V APPLICATION DEVELOPMENT ON .NET 7

Application Domains – Remoting – Leasing and Sponsorship - .NET Coding DesignGuidelines –Assemblies – Security – Application Development

MODULE VI WEB SERVICES 7

Web Services -Building an XML Web Service - Web Service Client – WSDL and SOAP – Web Servicewith Complex Data Types – Web Service Performance.

Theory Hours : 45

LIST OF EXERCISES

1. Programs using I/O Operations
2. Programs using Operators, Expressions and Statements
3. Program using Inheritance and overloading
4. Create application using Windows Forms
5. Create application using Web Forms
6. Program to access data source through ADO.NET.

Lab Hours: 30

Total Hours: 75

REFERENCES:

1. S. Thamarai Selvi and R. Murugesan “A Textbook on C# “, Pearson Education,2003.
2. Stephen C. Perry “Core C# and .NET”, Pearson Education,2006.
3. Jesse Liberty, “Programming C#”, Second Edition, O’Reilly Press, 2002.
4. Robinson et al, “Professional C#”, Fifth Edition, Wrox Press, 2002.
5. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw Hill, 2004.
6. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.
7. Thuan Thai and Hoang Q. Lam, “. NET Framework Essentials”, SecondEdition, O’Reilly, 2002.

OUTCOMES:

After completing this course, the student will be able to:

- List the major elements of the .NET frame work and discuss CLR.
- Explain how C# fits into the .NET platform.
- Analyze the basic structure of a C# application
- Debug, compile, and run a simple application.
- Develop programs using C# on .NET
- Design and develop Web based applications on .NET

ITCX108 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students

1. To introduce the fundamentals of artificial intelligence.
2. To introduce various searching techniques.
3. To introduce the ideas of fuzzy sets, fuzzy logic and reasoning and use of heuristics based on human experience.
4. Introduce the concept of expert systems and machine learning.
5. To understand the basic of machine learning concepts.

Prerequisite: Introduction to Algorithms

MODULE I INTRODUCTION **6**

Artificial Intelligence -History - The State of Art - Intelligent Agents - Structure - Environment.

MODULE II SEARCH STRATEGIES **8**

Breadth-First Search - Uniform Cost Search - Depth-First Search - Depth-Limited Search - Iterative Deepening Search - Bidirectional Search - Heuristic Search Techniques - A* Search - AO* Algorithm - Adversarial Search: Minimax Algorithm - Alphabeta Pruning.

MODULE III KNOWLEDGE AND REASONING **8**

Representation - First Order Predicate Logic – Inference – Unification - Forward and Backward Chaining - Resolution - Reasoning with Default Information - Truth Maintenance Systems - Acting under Uncertainty - Statistical Reasoning - Probability and Bayes Theorem - Certainty Factors and Rule Based Systems - Dempster-Shafer Theory.

MODULE IV PLANNING AND LEARNING **8**

Planning with State Space Search: Partial Order Planning - Planning Graphs - Examples. Forms of Learning: Inductive Learning - Explanation Based Learning - Statistical Learning - Learning With Complete Data.

MODULE V KNOWLEDGE ENGINEERING 8

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 VI MACHINE LEARNING 7

Frame work for learning – Inductive learning –Supervised, Unsupervised learning – Parallel distributed processing – Genetic Algorithms.

Total : 45 Hours

TEXTBOOK:

1. Stuart J Russell and Peter Norvig, — “Artificial Intelligence - A Modern Approach”, Third Edition, Prentice Hall of India/ Pearson Education, New Delhi, 2015.
2. Elaine Rich and Kevin Knight, — “Artificial Intelligence”, Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES:

1. Dan W Patterson, “Introduction to AI and Expert Systems”, Prentice Hall of India, New Delhi, 2010.
2. Eugene Charniak and Drew McDermott, “Introduction to Artificial Intelligence”, Pearson Education, New Delhi, 2010.
3. Stuart Russel and Peter Norvig, “Artificial Intelligence – a modern approach”, Prentice Hall, 2009.
4. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 2003.
5. Nils J Nilsson, “Principles of Artificial Intelligence”, Narosa Publishing House, New Delhi, 2000.

OUTCOMES:

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

- Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- Use various searching techniques for solving various AI problems.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- Identify the production systems and the search strategies. Acquire knowledge on the representation and reasoning techniques.

- 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.
- Have an exposure on machine learning problems and applications.

ITCX109	GRID COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an overview of the basic concepts of Grid Computing.
- To highlight the advantages of deploying Grid Computing.
- To study about grid security and grid resource management.
- To study about semantic grid concepts.
- To illustrate the practical adoption of a Grid deployment through real life case studies.

MODULE I CONCEPTS AND ARCHITECTURE **8**

Introduction-Parallel and Distributed Computing-Cluster Computing-Grid Computing-Virtual Organization and the Grid Standards-Anatomy and Physiology of Grid-Web and Grid Services.

MODULE II STANDARDIZATION OF GRID TECHNOLOGY **8**

Service Oriented Grid Architecture–Web Services-Open Grid Services Infrastructure-OGSA Services and Schema-OGSA implementations.

MODULE III GRID SECURITY **6**

Grid Security-A Brief Security Primer-PKI-X 509 Certificates-Grid Security Requirement -WS Security.

MODULE IV RESOURCE MANAGEMENT **8**

Grid Scheduling and Resource Management, Gridway and Gridbus Broker-principles of Local Schedulers- Overview of Condor, SGE, PBS,LSF-Grid Scheduling with QoS.

MODULE V KNOWLEDGE ORIENTED GRIDS **7**

Knowledge for Grid applications-Meta data, Knowledge and Semantics-Architectures for Knowledge Oriented Grids-Representing Knowledge-Case study.

MODULE VI GRID MIDDLEWARE 8

List of globally available Middlewares–Case Studies-Recent version of Globus Toolkit and gLite- Architecture, Components and Features. Features of Next generation grid.

Total Hours : 45

TEXT BOOKS:

1. Ian Foster, Carl Kesselman, “The Grid2: Blue print for a New Computing Infrastructure”, Elsevier Series, 2nd edition, 2004.
2. Parvin Asadzadeh, Raj kumar Buyya, Chun Ling Kei, Deepa Nayar, and Srikumar Venugopal, “Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies", Wiley Press, 2006.
3. Laurence Yang and Minyi Guo, "High Performance Computing: Paradigm and Infrastructure”, John Wiley & Sons, Wiley Press, New Jersey, 2006.

REFERENCES:

1. Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, “Grid Resource Management: State of the Art and Future Trends”, (International Series in Operations Research & Management Science), 1st Edition, Springer, Kluwer Academic Publishers, 2003.
2. “Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience”, Wiley Press, New York, USA, Wiley Press, 2008.
3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, “Grid Computing: Making The Global Infrastructure a Reality”, Wiley Press, 2003.

OUTCOMES:

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

- Outline the basic concepts of Grid Computing.
- Discuss the components of OGSA frame work.
- Design suitable methods for grid security.
- Compare the local and global grid scheduling mechanisms.
- Prepare a case study on knowledge oriented grid.
- Develop an application using any grid middleware.

ITCX110 INFORMATION CODING TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concept of information and entropy of Information.
- To understand the basic Modulation and its types.
- To familiarize with text compression techniques.
- To know about video compression, H.261 and MPEG standard.

MODULE I INFORMATION ENTROPY FUNDAMENTALS 8

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 8

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 7

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 7

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 8

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.

MODULE VI AUDIO AND VIDEO CODING 7

Linear predictive coding – code excited LPC – perceptual coding - MPEG audio coders – Dolby audio coders – video compression – H.261 and MPEG video standards.

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.

OUTCOMES:

On completion of the course students will be able to:

- Explain the different information coding theorems.
- Discuss the various modulation methods to encode data and voice.
- Apply the block codes and cyclic codes to detect errors.
- Discuss how error control coding techniques are applied in communication systems.
- Demonstrate the various text and image compression techniques.
- Demonstrate the various audio and video compression techniques.

ITCX111 MOBILE ADHOCNETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the difference between wired and adhocnetworks.
- Togaintheknowledgeabouttheapplicationsofadhocnetworks.
- To learn about the proactive and reactiveprotocols.
- To understand the concepts of reactive protocols in less mobile environment.
- To explain the concepts of reactive protocols in high mobile environment.
- To realize the importance of hybrid and hierarchicalprotocols

MODULE I INTRODUCTION **8**

Model of Operation- symmetric Links- Layer-2 Ad Hoc Solutions-Proactiveversus Reactive Protocols- Multicast- Commercial Applications of AdHoc Networking-Conferencing-HomeNetworking-EmergencyServices-PersonalAreaNetworksandBluetooth-EmbeddedComputingApplications-TechnicalandMarketFactorsAffectingAdHocNetworks-Scalability-PowerBudgetversusLatency-ProtocolDeploymentandIncompatibleStandards.

MODULE II CHANNELALLOCATION **8**

Channelallocationmethods–802-11WLAN–MACA–MACAW–MACABI– CSMA – TSMA.

MODULE III DESTINATION SEQUENCED DISTANCE VECTOR PROTOCOL **7**

Introduction-OverviewofRoutingMethods-Link-State-Distance-Vector-Destination-Sequenced Distance Vector Protocol- Protocol Overview-RouteAdvertisements-Route Table Entry Structure- Responding toTopologyChanges- Route Selection Criteria- Operating DSDV at Layer 2-ExtendingBaseStationCoverage-Performanceevaluationusingsimulators.

MODULE IV DYNAMIC SOURCE ROUTING PROTOCOL FORMULTI HOPWIRELESS NETWORK **7**

AdHocNetworksAssumptions-DSRProtocolDescription—OverviewandImportant Properties- DSR Route Discovery- DSR RouteMaintenance-AdditionalRouteDiscoveryFeatures-AdditionalRouteMaintenanceFeatures-Support for Heterogeneous Networks and Mobile IP- Multicast RoutingwithDSR-

LocationofDSRFunctionsintheISONetworkReferenceModel-Performance evaluation usingsimulators.

MODULE V AD HOC ON-DEMANDDISTANCE-VECTOR PROTOCOL 7

AODVProperties-UnicastRouteEstablishment-RouteDiscovery-ExpandingRing Search- Forward Path Setup- Route Maintenance-LocalConnectivityManagement-MulticastRouteEstablishment-RouteDiscovery-ForwardPathSetup-MulticastRouteActivation/Deactivation-MulticastTreeMaintenance-Performance evaluation usingsimulators.

MODULE VI HYBRID AND HIERARCHICAL ROUTING PROTOCOLS 8

ZRP:AHybridFrameworkforRoutinginAdHocNetworks-TheZoneRoutingProtocol-ZRP–FormalDescription-HiearchicalbasedRouting–HierarchicalStateRoutingProtocol,FisheyeRoutingProtocol.

Total Hours : 45

TEXTBOOKS:

1. Subir Kumar Sarkar, T-G- Basavaraju and C- Puttamadappa, “Ad Hoc Mobile Wireless Networks: Principles, Protocols, and Applications”, Second Edition, CRC Press, 2016
2. C. Siva Ram Murthy, B.S. Manoj, “Adhoc Wireless Networks”, PrenticeHall,2004-

REFERENCES:

1. C.K.Toh,“AdhocMobileWirelessNetworks:ProtocolsandSystems”,PearsonEducation,2009.
2. CharlesE.Perkins,“AdHocNetworking”,AddisonWesley, December2000.

OUTCOMES:

- Acquaint the basic knowledge of adhoc networks.
- Analyze the various channel allocation algorithms used in MAC layer.
- Explain the DSDV, DSR and AODV protocols.
- Compare the performance of DSDV, DSR and AODV protocols and implement any one protocol using simulator.
- Identify the difference between the protocols & practical issues.
- Evaluate the ZRP and Fisheye Routing Protocol.

ITCX113 TCP/IP PROTOCOL SUITE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce basics of computer networks, OSI model, layers of TCP/IP, types of addressing and Switching
- To learn about the protocols of network layers and subnetting / supernetting
- To learn basics of ns simulator
- To introduce the protocols of transport and application layers

MODULE I INTRODUCTION 07

Standards – Internet – History- OSI model – TCP/IP Protocol suite – Addressing –Switching – Connecting devices – IP addressing.

MODULE II INTERNET PROTOCOL 08

Subnetting – Supernetting – IP packets – Delivery – Routing – Routing module – Routing table – Datagram – Fragmentation – Checksum – IP Design – ARP – RARP.

MODULE III ICMP & IGMP 08

Internet control message protocol – Multicasting -Internet group management protocol – Introduction to NS simulator.

MODULE IV TRANSMISSION CONTROL PROTOCOL 08

User Datagram protocol – UDP operation – Use – UDP design – TCP services – Flow control – Error control – TCP operation and design – Connection – Congestion control.

MODULE V APPLICATION LAYER AND CLIENT SERVER MODEL 08

Concurrency – BOOTP – DHCP – Domain name system – Name space – Distribution – Resolution – Messages – Telnet – Rlogin – Network Virtual Terminal – Character Set – Controlling the server – Remote login.

MODULE VI APPLICATION PROTOCOLS 06

File Transfer Protocol – Connections – Communication – Simple Mail Transfer Protocol – Simple Network Management Protocol – Hyper Text Transfer Protocol – Transaction – Request and Response messages.

Total Hours : 45

TEXT BOOK:

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Tata McGraw Hill fourth Edition 2010.

REFERENCE:

2. Douglas E. Comer, David L. Stevens, “Internetworking with TCP/IP – Volume I, II and III”, Prentice - Hall of India Pvt. Ltd., 6th Edition 2015.

3. Mahbub Hassan and Raj Jain, “High Performance TCP/IP Networking Concepts, Issues and Solutions”, Prentice - Hall of India Pvt. Ltd, 2015

OUTCOMES:

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

- Describe the history, the need and the purpose of TCP/IP and basics of computer networks and its layers
- Design networks using subnet and supernet concepts and explain the working of IP, ARP and RARP protocols
- Explain the working of ICMP and IGMP protocols along with multicasting
- Create a network topology using ns simulator and monitor the performance of the network
- Enlighten transport layer protocols (TCP and UDP)
- Explicate application layer protocols.

PROGRAM ELECTIVES – III (6 Credit)

ITCX212	HYBRID APPLICATION DEVELOMENT(LABORATORY)	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To know the importance of hybrid applications.
- To learn the fundamentals of hybrid application development.
- To develop simple hybrid applications using AngularJS.

THEORETICAL STUDY

HYBRID APPLICATION DEVELOPMENT **15**

Introduction - Computing eras & current mobile wave - Platforms, Frameworks & Tools - Hybrid frameworks, web tech, web APIs (backend) - The stack – HTML5/CSS3/AngularJS - Ionic – AngularJS and native-like – Phonegap.

JS Basics - JS Frameworks - AngularJS Intro - Ionic Framework, Why Ionic? - Ionic 1 / 2 - NodeJS / NPM - Data Binding & Filters - Module, Controller & Views – Directives – Services – Routing - Angular JS 2 changes – Components – Typescript - Working with Angular code.

Project Structure - Application Logic - Screen Templates - Ionic components - Navigation Stack - Application structure and screens - Integrating the screens - Component customization - Working with Web APIs - Integrating Device Features.

LABORATORY PRACTICE **30**

- Developing Simple Hybrid Applications using AngularJS (4 exercises)
- Hybrid application development in AngularJS. (Students can select their own problem to develop an Application)

  Sample applications
  - Simple Conversion Apps
  - ToDo App
  - Employee Directory
  - Tourism App
  - Games

Total Hours : 45

REFERENCES:

1. Chris Griffith, “Mobile App Development with Ionic”, O’Really Media, Inc. 2017
2. Asep Edi Kurniawan, “Mobile App Development with Angularjs and Ionic”, Leanpub 2015.
3. Jeremy Wilken, “Ionic in Action: Hybrid Mobile Apps with Ionic and AngularJS”, Manning Publication 2015.
4. Vinci Rufus, “AngularJS Web Application Development Blueprints”, Packt Publishing 2014.

OUTCOMES:

On completion of the course students will be able to :

- Create mobile apps with HTML, JavaScript, and CSS.
- Describe the components and structure of a hybrid application development frameworks (Ionic, phonegap, etc.) and learn how and when to apply the different components to develop a working system.
- Design complex interfaces with Ionic’s UI controls.
- Build once and deploy for both iOS and Android.
- Design, implement and deploy hybrid applications using an appropriate software development environment

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ITCX213 DATA MINING TECHNIQUES AND TOOLS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To introduce the concept of data mining with a detailed coverage of basic tasks, metrics and Implementation of Data Warehouse.
- To provide knowledge in association rule mining.
- To understand the classification algorithms.
- 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 – 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 – Bayes Classification Methods - 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.

Theory: 30

Practical Session:

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

Note: Use R Tool or Weka Tool.

Lab: 30

Total Hours : 30 + 30 = 60

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei, “Data Mining Concepts and Techniques”, Third Edition, Elsvier Inc., 2012.
2. G.K. GUPTA, “Introduction to Data Mining with Case Studies”, Third Edition, PHI Learning Private Limited, 2014.
3. Yanchang Zhao, Yonghua Cen, “Data Mining Applications with R”, Academic Press, 2014.

REFERENCES:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson Education,New Delhi, 2007.
2. Margaret Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education, New Delhi, 2007.
3. Gupta K, “Introduction to Data Mining with Case Studies”, PHI Learning Private Ltd, New Delhi, 2011.
4. Daniel T.Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006.

OUTCOMES:

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

- Explain the concept of data warehousing
- Preprocess the data
- Discuss the association rule mining
- Cluster and classify the given data
- Demonstrate the data mining tools

ITCX215 SOFTWARE REQUIREMENTS MANAGEMENTAND SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the basic concepts of software requirements.
- To learn the software requirements management concepts.
- To learn the basic concepts of software project management and software estimation methods.
- To know the software product estimation techniques.
- To learn how to manage risks and allocate resources for software projects.

MODULE I INDTRODUCTION TO SOFTWARE REQUIREMENTS 7

The essential software requirement - Good practices for requirements engineering - The business analyst role - Requirements elicitation - Documenting the requirements

MODULE II SOFTWARE REQUIREMENTS MANAGEMENT 8

Requirements management practices: Requirements management process - The requirements baseline - Requirements version control - Requirement attributes - Tracking requirements status - Resolving requirements issues - Measuring requirements effort - Managing requirements on agile projects - Why manage requirements? - Change happens - Tools for requirements engineering

MODULE III PROJECT MANAGEMENT CONCEPT 9 RISK MANAGEMENT 8

Introduction to software project Management - Project evaluation and programme Management - An overview of project planning

MODULE IV SOFTWARE ESTIMATION & COSTING 8

Selection of an appropriate project Approach - Software effort estimation - Activity planning

MODULE V RISK MANAGEMENT 7

Risk management - Resource allocation - Monitoring and control - Managing contracts

MODULE VI **PEOPLE MANAGEMENT** **7**

Managing people in software Environments - Working in teams - Software quality

Total Hours : 45

TEXT BOOKS:

1. McConnell, S. “Software Requirements”, 3rd edition, Microsoft Press, 2013.
2. Bob Hughes and Mike Cotterell, “Software Project management”, 5th edition, Mc Graw Hill, 2009.

REFERENCES:

1. Adolfo Villafiorita, "Introduction to Software Project Management", CRC Press, 2014.
2. Ashfaque Ahmed, "Software Project Management: A Process-Driven Approach", CRC Press, 2012.
3. Dr. Tuhin Chattopadhyay, "How to Be a Successful Software Project Manager", Partridge Publishing, 2015.
4. Anna P. Murray, "The Complete Software Project Manager: Mastering Technology from Planning to Launch and Beyond", John Wiley & Sons. 2016.

OUTCOMES:

- Students will explain the concepts of software requirements elicitation.
- They will be able to explain how to change and control the requirements.
- Students will know the software project management and software estimation methods.
- They will have capability to prepare project plan.
- Students will be ready to identify and analyze risks.
- They will express how to manage people.

ITCX216 BUSINESS AND DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain an understanding business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with data analysis techniques to develop, report, and analyze business data.
- To learn to use advanced analytics and model evaluation to solve business problems.

MODULE I INTRODUCTION 7

Introduction to Business Analytics, data mining, Big Data and data science, steps in data mining, preliminary steps.

MODULE II BUSINESS ANALYTICS LIFE CYCLE 8

Business Analytics Process, CRISP-DM, predictive power and over fitting, using JMP, automated data mining solutions.

MODULE III DATA EXPLORATION AND DIMENSION REDUCTION 8

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 IV PERFORMANCE EVALUATION 7

Evaluating Predictive performance, judging classifier performance, judging ranking performance, and oversampling.

MODULE V ADVANCED ANALYTICS 8

Multiple linear regression, k-nearest neighbors, classification and regression trees, logic regression, neural nets, discriminative analysis.

MODULE VI MODEL EVALUATION TECHNIQUES 7

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.

Total Hours : 45

TEXT BOOKS:

1. Galit Shmueli ,Peter C. Bruce,Mia L. Stepiiens, Nitin R. Patel, "Data Mining For Business Analytics Concepts, Techniques, and Applications with JMP Pro", John Wiley & sons, 2017.
2. Daniel T. Larose & Chantal D. Larose, "Discovering Knowledge in Data: An Introduction to Data Mining", Wiley, Second Edition.

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.

OUTCOMES:

On completion of the programme students will be able to:

- Explain the business analytics and data mining concepts
- Understand the life cycle of business analytics
- Apply data visualization and dimension reduction techniques
- Evaluate the performance of prediction methods
- Apply the knowledge of advanced analytic techniques
- Discuss on various model evaluation techniques

ITCX217 WEBSERVICES L T P C
3 0 0 3

OBJECTIVES:

- To learn the XML based standards for creating XML application.
- To understand the architecture of web services and its underlying infrastructure.
- To gain knowledge about SOAP, WSDL and UDDI.
- To explore HTTP, from the request/response cycle to its verbs, headers, and cookies
- To choose the service that works best for an application.

MODULE I XML TECHNOLOGYFAMILY 8

XML – benefits – Advantages of XML over HTML, Databases – XMLbasedstandards–Structuringwithschemas-DTD–XMLSchemas–XMLprocessing DOM – SAX – presentation technologies – XSL – XFORMS – XHTML– Transformation–XSLT–XPATH–XQuery.

MODULE II MOTIVATIONS FOR WEBSERVICES 7

Businessmotivationsforwebservices–B2B–B2C–Technicalmotivations-limitationsofCORBAandDCOM–Service-orientedArchitecture(SOA).

MODULE III ARCHITECTING WEB SERVICES 7

Architectingwebservices–Implementationview–webservicestechnologystack–logicalview–compositionofwebservices–deploymentview–fromapplicationservertopeertopeer–processview–lifeintheruntime.

MODULE IV WEB SERVICES BUILDINGBLOCKS 7

Transportprotocolsforwebservices–messagingwithwebservices–protocols -SOAP-describingwebservices–WSDL–AnatomyofWSDL–manipulating WSDL–webservicepolicy–Discoveringwebservices–UDDI–AnatomyofUDDI–Webserviceinspection–Ad-HocDiscovery-Securingwebservices.

MODULE V HTTP VERBS AND HEADERS 8

HTTP – Clients and Servers – Making HTTP requests - HTTP Verbs - Serving GET request- Making GET request – Handling POST request – Making POST request- Headers –request response headers – identify clients with user agents – Headers

for content negotiation – Securing headers with authorization headers – caching headers – custom headers.

MODULE VI BUILDING API **8**

Cookies- Cookies Mechanics – reading and writing cookies – making request with cookies- cookies and APIs – JSON- Handling JSON with PHP – Consuming JSON APIs – XML in PHP – Consuming XML APIs – Sample API application.

Total Hours : 45

TEXTBOOKS:

1. Ron Schmelzer, Travis Vandersypen, Jason Bloomberg, Madhu Siddalingaiah and Sam Hunting, “XML and Web Services Unleashed”, Pearson Education, 2008.
2. Sandeep Chatterjee andJamesWebber,“DevelopingEnterpriseWebServices:AnArchitect’sGuide”, Pearson Education,2004.
3. Lorna Jane Mitchell,“PHP Web Services – APIs for the Modern Web” 2nd edition, O’reilly , 2016.

REFERENCES:

1. Keith Ballinger, “.NET Web Services Architecture andImplementation”,Pearson Education,2003.
2. DavidChappell,“Understanding.NETATutorialandAnalysis”,AddisonWesley,2002.
3. KennardScibnerandMarkC.Stiver,“UnderstandingSOAP”,SAMSpublishing.
4. AlexanderNakhimovskyandTomMyers,“XMLProgramming:WebApplications and Web Services with JSP and ASP”, Apress,2002.

OUTCOMES:

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

- Create, validate and parse XML documents.
- Analyze the B2B and B2C real world applications.
- Explain the logical and deployment view of web service technology stack.
- Use SOAP, WSDL and UDDI for creation of a web service.
- Work with JSON and XML technologies.
- Use the best service for a given application and make it robust.

ITCX218 IMAGE PROCESSING L T P C

3 0 0 3

OBJECTIVES:

- To study the basic principles and concepts in digital image processing.
- To provide the application of digital image analysis moving towards image interpretation.
- To know the techniques and tools for digital image processing, and finally also introduce image analysis techniques in the form of image segmentation.
- To study the image fundamentals and mathematical transforms necessary for image processing.

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Digital image fundamentals – Examples of fields that use image processing – Components of image processing systems - Elements of Visual Perception – Light and the Electromagnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization – Relationship between Pixels – Mathematical tools used in image processing.

MODULE II DIGITAL IMAGE TRANSFORMS 8

Basic geometric transformations – Introduction to Fourier Transform and DFT, Properties of 2D Fourier Transform, FFT, Separable Image Transforms, Walsh, Hadamard, Discrete Cosine Transform, Haar, Slant –Karhunen–Loeve transforms.

MODULE III IMAGE ENHANCEMENT TECHNIQUES 7

Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters : Smoothing, Sharpening filters.

MODULE IV IMAGE RESTORATION 7

Model of Image Degradation/restoration process, Noise models, Inverse filtering, Least mean square filtering, Constrained least mean square filtering, Blind image Restoration, Pseudo inverse, Singular value decomposition.

MODULE V IMAGE COMPRESSION 8

Need for data compression, Lossless compression: Variable length coding, LZW coding, Bit

Plane coding, predictive coding - DPCM. Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

MODULE VI IMAGE SEGMENTATION AND REPRESENTATION 7

Edge detection, Thresholding, Region Based segmentation, Boundary representation: chair

Codes – Polygonal approximation, Boundary segments, boundary descriptors: Simple descriptors – Fourier descriptors, Regional descriptors, Simple descriptors.

Total Hours : 45

REFERENCES:

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, 3rd Edition, Pearson Education, 2009.
2. William K Pratt, “Digital Image Processing”, John Willey, 2001.
3. Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, “Image Processing Analysis and Machine Vision”, 1999.
4. A.K. Jain, PHI, “Fundamentals of Digital Image Processing”,New Delhi ,1995.
5. Chanda Dutta Magundar, “Digital Image Processing and Applications”,Prentice Hall of India, 2000.

OUTCOMES:

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

- Explain the basic elements and applications of image processing.
- Create Gray level transformations for Image enhancement.
- Design and implement two-dimensional spatial filters for image enhancement.
- Select Wiener filtering for de-blurring and noise removal.
- Analyze the techniques for image compression and segmentation.
- Apply digital image analysis techniques and enhance their critical thinking skills in digital color images.

ITCX219	EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the basic concepts of expert systems.
- To know the languages and tools for building expert systems.
- To study about representing knowledge & knowledge acquisition.
- To understand the various heuristics for building expert systems.

MODULE I INTRODUCTION TO EXPERT SYSTEMS 7

Definition, Features of an expert system, Organization, Characteristics, Uses, Basic activities of expert systems, Prospector, Knowledge Representation in expert system, an overview of Artificial Intelligence.

MODULE II RULE-BASED EXPERT SYSTEM 8

Introduction to Rule-based systems – Canonical systems, production systems for problem solving, the syntax of rules, working memory, controlling behavior of the interpreter, conflict resolution, forward and backward chaining, rules and meta-rules.

MODULE III LANGUAGES TO BUILD AN EXPERT SYSTEM 8

Symbolic computation-Symbolic representation, Physical symbols systems, Introduction to LISP, LISP data structures, LISP programs, List processing, pattern matching. Logic Programming- Formal languages, propositional calculus, the predicate calculus, the PROLOG language, PROLOG and MBASE, PROLOG's search rules, Object-oriented analysis and design for expert systems.

MODULE IV EXPERT SYSTEMS TOOLS 7

Overview of expert systems tools, expert system shells, high-level programming languages, constraints of production rule languages, evaluating object-oriented approaches, logic programming for expert systems, multiple-paradigm programming environments, potential implementation problems, More maxims on expert system development, Building an Expert System-MYCIN, EMYCIN.

MODULE V KNOWLEDGE ACQUISITION **8**

Theoretical analysis of knowledge acquisition, Stages of knowledge acquisition, Ontology analysis, Expert system shells, Knowledge acquisition methods, Knowledge-based knowledge acquisition, Introduction to Machine Learning.

MODULE VI CLASSIFICATIONS OF EXPERT SYSTEM TASKS **7**

Classification of expert system tasks, heuristic matching, classification, The generality of heuristic classification, Classification versus construction, mapping tools to tasks, knowledge acquisition strategies, Managing complexity, classification problem solving.

Total Hours : 45

TEXT BOOKS:

1. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Education, 2003.
2. Donald A. Waterman, “A Guide to Expert Systems”, Addison Wesley, 1999.

REFERENCES:

1. W. Patterson, ‘Introduction to Artificial Intelligence and Expert Systems’, Prentice Hall of India, 2003.
2. Elain Rich and Kevin Knight, ‘Artificial Intelligence’, Second Edition, Tata McGraw Hill, 1995.

OUTCOMES:

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

- Explain the concepts of expert systems.
- Write the rules for designing expert system
- Develop programs using LISP and PROLOG
- Analyze the knowledge acquisition in expert system
- Develop programs using machine learning concepts
- Build a new expert system using various tools

ITCX220	SERVICE ORIENTEDARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain understanding of the basic principles of service orientation.
- To understand web services and service abstraction.
- To learn service oriented analysis and coordination techniques.
- To use the concepts of SOAP and WSDL for designing applications.
- Tolearntechnologies underlyingthedesign of xml based web services.
- To know about various WS-* specification standards, web service security and service transaction.

MODULE I SOAFUNDAMENTALS **8**

RootsofSOA–CharacteristicsofSOA-ComparingSOAtoclient-serveranddistributedinternetarchitectures–AnatomyofSOA-HowcomponentsinanSOAinterrelate-Principlesofserviceorientation.

MODULE II WEB SERVICES & SERVICE ABSTRACTION **8**

Webservices–Servicedescriptions–MessagingwithSOAP–Message exchangePatterns–Coordination–AtomicTransactions–Businessactivities – Orchestration–Choreography-Servicelayerabstraction–ApplicationServiceLayer–BusinessServiceLayer–OrchestrationServiceLayer.

MODULE III SERVICE-ORIENTED ANALYSIS &DESIGN **8**

Serviceorientedanalysis–Business-centricSOA–Derivingbusiness services-service modeling-ServiceOrientedDesign–WSDLbasics–SOAPbasics–SOAcompositionguidelines–Entity-centricbusinessservicedesign–Application service design – Task centric business servicedesign.

MODULE IV XML BASED WEB SERVICES **9**

SOAplatformbasics–SOAsupportinJ2EE–JavaAPIforXML-basedwebservices(JAX-WS)-JavaarchitectureforXMLbinding(JAXB)–JavaAPIforXMLRegistries(JAXR)-JavaAPIforXMLbasedRPC(JAX-RPC)-Web Services Interoperability

Technologies (WSIT) - SOA support in .NET– CommonLanguageRuntime-ASP.NETwebforms–ASP.NETwebservices – Web Services Enhancements(WSE).

MODULE V SERVICE COORDINATION AND WEB SERVICESSECURITY **6**

WS-BPEL basics – WS-Coordination overview - WS-Choreography,WS-Policy,WS -Security.

MODULE VI SOA TRANSACTION & PROTOCOLCOORDINATION **6**

Transactionprocessing–paradigm–protocolsandcoordination–transactionspecifications – SOA in mobile – researchissues.

Total Hours : 45

REFERENCES:

1. Thomas Erl, “Service-Oriented Architecture: Analysis and Design for Services and Microservices”, Second Edition, Prentice Hall, Service Tech Press,2016.
2. Newcomer, Lomow, “Understanding SOA with Web Services”,Pearson Education,2005.
3. SandeepChatterjee,JamesWebber,“DevelopingEnterpriseWebServices-AnArchitect”sGuide”,PearsonEducation,2005.
4. DanWoodsandThomasMattern,“EnterpriseSOADesigningITforBusinessInnovation”, First Edition, O’Reilly,2006.
5. Shankar Kambhampaly, “Service–Oriented Architecture forEnterprise Applications”,WileyIndiaPvtLtd,2008.

OUTCOMES:

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

- Compare service oriented architecture with other internet architectures.
- Analysis about web services and service abstraction.
- Discuss about service-oriented analysis and design.
- Design a web service using SOAP and WSDL to support SOA based applications.
- Identify research issues in service coordination, web services security and choreography in service layers.
- Explain the various WS-* specification standards and research issues in SOA.

ITCX221 PERVASIVE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about the applications of pervasive computing.
- To understand the use of pervasive computing on web applications.
- To study about PDA's using pervasive computing.
- To learn the user interface issues and web applications in pervasive computing.

MODULE I INTRODUCTION **7**

Pervasive Computing Application- Pervasive Computing devices and Interfaces Device technology trends, Connecting issues and protocols. Pervasive Computing Market -m-Business – Application examples: Retail, Airline -check- in and booking – Health care – Car information system – E-mail access via WAP and voice.

MODULE II WEB APPLICATION CONCEPTS **8**

Pervasive Computing and web based Applications- XML and its role in Pervasive Computing- Wireless Application Protocol (WAP) Architecture and Security- Wireless Mark-Up language (WML)– Introduction.

MODULE III VOICE TECHNOLOGY **7**

Voice Enabling Pervasive Computing- Voice Standards- Speech Applications in Pervasive Computing and security – java for pervasive devices, Biometrics.

MODULE IV PERSONAL DIGITAL ASSISTANTS **8**

User Interface Issues in Pervasive Computing, Architecture - Smart Card-based Authentication Mechanisms- Wearable computing Architecture. Case study- Wearable computing / Cyber physical system.

MODULE V USER INTERFACE ISSUES **7**

User Interface Issues in Pervasive Computing, Architecture - SmartCard-based Authentication Mechanisms- Wearable computing Architecture. Case study- Wearable computing / Cyber physical system.

MODULE VI PERVASIVE WEB APPLICATION ARCHITECTURE **8**

Introduction-scalability and availability- Development of Pervasive computing Web

Applications-Pervasive application architecture. Example application– User interface over view– Architecture– Implementation.

Total Hours : 45

TEXT BOOKS:

1. Horst Henn, Jochen Burkhardt, Klaus Rindtorff, Stefan Hepper, Thomas Schaeck, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", ISBN 10: 8177582801 / ISBN 13: 9788177582802, Pearson Education, 14th Edition, 2012.
2. Uwe Hansman, Lothat Merk, Martin S Nicklous &Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer- Verlag, New Delhi, 2003.
3. Hagras Abraham Hassanien, "Pervasive Computing-Innovations in Intelligent Multimedia and Applicaitons", Springer, 2009.

REFERENCES:

1. Rahul Banerjee, "Internetworking Technologies: An Engineering Perspective", Prentice–Hall of India, New Delhi, (ISBN81-203-2185-5).2003.
2. Rahul Banerjee, "Lecture Notes in Pervasive Computing", Outline Notes, BITS-Pilani, 2003.

OUTCOMES:

On completion of the course students will be able to:

- Outline the basics of pervasive computing device technologies.
- Identify the protocols used in pervasive computing.
- Assess the voice standards and applications in pervasive computing.
- Compile the characteristics of PDA devices.
- Discuss various user interface issues in pervasive computing.
- Develop a Pervasive computing Web Application

ITCX222 KNOWLEDGE BASEDDECISION SUPPORTSYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with the theoretical perspectives of knowledgecreation,knowledgetransfer,knowledgesharing,andknowledgeleadership rolesandskills.
- Tounderstandhowthestudyofcommunicationrelatestoknowledge developmentandknowledgesharinginorganizations.
- Tounderstand therelationshipbetweenknowledgemanagementandalearningorganization,Development ofsupportsystemMethodsofmanagingknowledgeIntelligentdecisionsystemdevelopment.

MODULE I INTRODUCTION 7

Decision making, Systems, Modeling, and support - Introductionand Definition-Systems-Models-Modelingprocess-Decisionmaking:Theintelligence phase - The design phase - The choice phase - Evaluation:Theimplementation phase -Alternative Decision - Making models -Decisionsupport systems - Decision makers - Caseapplications.

MODULE II DECISION SUPPORT SYSTEMDEVELOPMENT 8

Decision Support System Development: Introduction - Life cycle- Methodologies - prototype - Technology Levels and Tools -Developmentplatforms - Tool selection - Developing DSS. Enterprise systems:Conceptsand Definition - Evolution of information systems - Information needs- Characteristicsandcapabilities– ComparingandIntegratingEISandDSS- EIS data access, Data Warehouse, OLAP, Multidimensionalanalysis, Presentationandtheweb-Includingsoftinformationenterpriseonsystems-OrganizationalDSS-supplyandvaluechainsanddecisionsupport-supply chain problems and solutions - computerized systems MRP, ERP, SCM - frontline decision supportsystems.

MODULE III KNOWLEDGEMANAGEMENT 8

Introduction-Organizationallearningandmemory-Knowledgemanagement - Development -methods, Technologies, and Tools - success-Knowledgemanagement

and Artificial intelligence - Electronic documentmanagement. Knowledge acquisition and validation: Knowledge engineering - Scope- Acquisitionmethods-Interviews-Trackingmethods-Observationandothermethods - Grid analysis - Machine Learning: Rule induction,case-basedreasoning-Neuralcomputing-Intelligentagents-Selectionofanappropriateknowledgeacquisitionmethods-Multipleexperts-Validationandverificationof the knowledge base - Analysis, coding, documenting, and diagramming- Numeric and documented knowledge acquisition - KnowledgeacquisitionandtheInternet/Intranets.

MODULE IV KNOWLEDGE REPRESENTATION ANDINFERENCE TECHNIQUES 8

Knowledge representation: Introduction - Representation in logic andotherschemas - Semantic networks - Production rules - Frames -Multipleknowledge representation - Experimental knowledge representations-Representinguncertainty.InferenceTechniques:Reasoninginartificialintelligence-Inferencewithrules:TheInferencetree-Inferencewithframes-Model-based and case-based reasoning - Explanation and Metaknowledge- Inferencewithuncertainty-Representinguncertainty-Probabilitiesandrelatedapproaches-Theoryofcertainty-Approximatereasoningusingfuzzylogic.

MODULE V INTELLIGENT SYSTEMDEVELOPMENT 7

IntelligentSystemsDevelopment:Prototyping:ProjectInitialization–Systemanalysis and design - Software classification: Building expert systemswithtools - Shells and environments - Software selection - Hardware-Rapidprototyping and a demonstration prototype - System development- Implementation-Postimplementation.

MODULE VI MANAGEMENT SUPPORTSYSTEMS 7

Implementing and integrating management support systems-Implementation:Themajorissues-Strategies-Systemintegration–GenericmodelsMSS,DSS,ES-IntegratingEIS,DSSandES,andglobalintegration IntelligentDSS-Intelligentmodelingandmodelmanagement–Examplesofintegrated systems - Problems and issues in integration. Impacts of Management Support Systems - Introduction - overview -Organizationalstructureandrelatedareas-MSSsupporttobusinessprocessreengineering Personnel management issues - Impact on individuals - Productivity,quality, and competitiveness - decision making and the managermanager”s job-Issuesoflegality,privacy,andethics-Intelligentsystemsandemployment levels - Internet communication - other societal

impacts -managerial implications and social responsibilities.

Total Hours : 45

TEXTBOOK:

1. Efrain Turban, Jay Aaronson, "Decision Support Systems andIntelligentSystems", 6th Edition, Pearson Education,2001.

REFERENCES:

1. GaneshNatarajan,SandhyaShekhar,"Knowledgemanagement–EnablingBusiness Growth", Tata McGraw Hill,2002.
2. GeorgeM.Marakas,"DecisionSupportSystem",PrenticeHall,India,2003.
3. Efrem A.Mallach, "Decision Support and Data Warehouse Systems",Tata McGraw-Hill,2002.

OUTCOMES:

- Outline the relationship between business information needs and decision making
- Explain the development of decision support systems.
- Discuss the role of knowledge management.
- Identify the various knowledge representation and inference techniques.
- Analyze the working of an intelligent system development.
- Evaluate the function of management support systems.

ITCX223 ELECTRONICSCOMMERCE L T P C
3 0 0 3

OBJECTIVES:

- To have an awareness about security and legal issues inecommerce to investigate the strategic implications of e-commerce with emphasis on existing companies
- To navigate positioning strategies available within the e-commerce landscape
- To develop the ability to quickly and effectively research Internet companies and strategies
- To learn to distinguish between temporary tremors and seismic shifts in the unstable e-commerce landscape

MODULE I INTRODUCTION 8

Introduction – Electronic Commerce Framework – The Anatomy ofE-Commerce Applications- The Network Infrastructure for E-Commerce- TheInternetasaNetworkInfrastructure - World of Blogs.

MODULE II ELECTRONIC COMMERCE AND EDI 8

Electronic Payment Systems- Interorganizational Commerce and EDI - EDIImplementation -MIMEandValueaddedNetworks- ecommerce security and fraud detection.

MODULE III ADVERTISING AND MARKETING 8

Advertising and Marketing on the Internet- Computer Based EducationandTraining - Technological Components of Education on-Demand- DigitalCopyrights and Electronic Commerce -SoftwareAgent - Website Design Issues- Factors that Make People Return to Your Site- Strategies for Website Development.

MODULE IV CORPORATE DIGITAL LIBRARY 8

TheCorporateDigitalLibrary–DimensionsofInternalElectronicsCommerceSystems - Making a Business case for a document Library - Types ofDigital documents - Issues behind document Infrastructure- Corporatedata warehouses- Documents Active / Compound documentarchitecture.

MODULE V DOCUMENT TYPES 8

Structured Documents-Structured DocumentFundamentals-

DocumentInterchangeRepresentations-SeparatingLogicalStructurefromPhysicalStructure - DocumentMarkup-DocumentMarkupLanguages.

MODULE VI MULTIMEDIA AND ECOMMERCE 5

MultimediaandDigitalVideo–BroadbandTelecommunications–MobileandWireless ComputingFundamentals-Social networks and online communities- Online auctions including Ebay-Ecommerce portals-Mobile Commerce.

Total Hours : 45

TEXTBOOK:

1. Kalakota&Whinston,“FrontiersofElectronicCommerce”,PearsonEducation ,2002.

REFERENCES:

1. KamaleshK.Bajaj,“E-Commerce:TheCuttingEdge&Business”,Tata McGraw-Hill,2003.
2. Brenda Kennan, “Managing your E-Commerce Business”, Prentice HallofIndia,2001.
3. Elias M. Awad, “Electronic Commerce from Vision to Fulfillment”,PrenticeHallofIndia,2003.
4. BharatBhaskar,“ElectronicCommerce–Framework,TechnologyandApplication”, TMH,2003.
5. Effy Oz, “Foundations of E-Commerce”, Prentice Hall of India,2001.
6. JimACarter,“DevelopingE-CommerceSystems”,PrenticeHallofIndia,2001.

OUTCOMES:

On completion of the programme students will be able to:

- Demonstrate an understanding of the foundations and importance of ECommerce
- Demonstrate an understanding of the impact of eCommerce on business models and strategy
- Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
- Describe the infrastructure for ECommerce
- Demonstrate an understanding of eCommerce related programming, database, and networking issues.
- Recognize legal, global, privacy, security and risk management issues in ECommerce

ITCX224 INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL IOT

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students

- To understand the basic concepts of Industry 4.0.
- To explain the concept of cyber security and data analytics.
- To gain basic knowledge in Industrial IoT.
- To explore the concepts of big data analytics and IIoT.
- To learn security in IIoT.
- To understand the applications and tools of IIoT.

MODULE I INTRODUCTION to INDUSTRY 4.0 **8**

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 **8**

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis – Cyber security in Industry 4.0

MODULE III BASICS OF INDUSTRIAL IoT **7**

Basics of Industrial IoT: Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models, IIoT Reference Architecture - Industrial IoT- Layers: IIoT Sensing- IIoT Processing- IIoT Communication.

MODULE IV BIG DATA ANALYTICS AND IIoT **8**

Industrial IoT- Layers: IIoT Communication, IIoT Networking - Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science, R and Julia Programming, Data Management with Hadoop.

MODULE V SECURITY IN IIoT 7

Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT - Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT - Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

MODULE VI APPLICATIONS OF IIoT 7

Industrial IoT- Application Domains: 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.

Total Hours : 45

TEXT BOOKS :

1. Gilchrist & Alasdair, “Industry 4.0: The Industrial Internet of Things”, Apress, 2016
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat , “Industrial Internet of Things: Cyber manufacturing Systems”, Springer, 2017

OUTCOMES:

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

- Explain the basic concepts of Industry 4.0.
- Describe the Cyber Security and Augment Reality.
- Develop the business model in IoT.
- Explain big data analytics.
- Describe security in IIoT
- Understand the opportunities, challenges brought about by Industry 4.0

PROFESSIONAL ELECTIVES IV (9 Credits)

ITCX117 CLOUD MIDDLEWARE TOOLS(LABORATORY)

L	T	P	C
1	0	2	2

OBJECTIVES:

- To understand the datacenter resources in cloud middleware environment.
- To implement creation of virtual machines and accessing cloud services.
- To create virtual machines with different operating systems using open source middleware technologies.
- To design and access private, public and hybrid clouds.
- To analyze various cloud middleware tools and their functionalities.

THEORY COMPONENT

MODULE I INTRODUCTION 7

Introduction to Physical and Viirtual Machine resources – Viirtualization – Hypervisor - Data Center - Cloud Services - IaaS, PaaS, SaaS, Operating systems - Virtual Appliances – vApps & AppV

MODULE II PRIVATE, PUBLIC AND HYBRID CLOUD 8

Private Cloud Tools - VMware workstation, VirtualBox, VMware vCenter Convertor, vApps, Open Source Cloud Middleware Tools & Technologies - Eucalpytus, OpenNebula, and Openstack Cloud IaaS, Public Cloud - Amazon EC2, Hybrid Cloud, Oracle Fussion

LAB COMPONENT - LIST OFEXERCISES

1. Study of Physical Machine&virtualmachines resources
2. CreationofVirtualMachinesusingVMware workstation, VirtualBox, VMware vCenter Convertor
3. Virtual Appliances - vApps & AppV
4. CreatingWindowsandUbuntuvirtual data centers usingEucalpytusand OpenNebula-OpenSourceMiddlewaretechnology.
5. Cloud service provisioning - IaaS, PaaS, SaaS
6. Openstack Cloud IaaS solution-nova, neutron, cinder, glance, swift
7. Amazon EC2
8. Hybrid cloud
9. Cloud Middleware Integration Consulting - .NET/JAVA—SOAP/REST

10. Database Middleware Automation
11. Oracle Fussion Middleware

Total Hours : 45

OUTCOMES:

- Analyze physical and virtual machines management in remote cloud servers.
- Design virtual machines using various hypervisors and cloud middleware products.
- Demonstrate Windows and Ubuntu virtual machines using open source middleware technologies.
- Identify and evaluate private, public and hybrid clouds and IaaS, PaaS, SaaS service provisioning.
- Build cloud platform for digital business.

ITCX 118 **BIG DATA TOOLS AND TECHNOLGIES(LABORATORY)** **L T P C**

1 0 2 2

OBJECTIVES:

- To make the students familiar with Hadoop distributed file system and can learn how to configure Hadoop.
- To install and configure various tools in Hadoop ecosystem.
- To provide a complete knowledge about Hadoop echo system with key components like Pig, Hive and Sqoop.
- To Install Apache Spark and explore the components in it.

MODULE I INTRODUCTION TO BIGDATA 7

Overview of Big Data: Big Data Characteristics, Challenges–Architecture of Big Data- Hadoop Eco System; Hadoop and its features; Anatomy of File read and write – Hadoop Architecture – HDFS – Map Reduce Paradigm – Map Reduce – Combiner, Partitioner- Anatomy of Map Reduce program Hadoop Storage – Different Hadoop Distributions.

MODULE II DISTRIBUTED FRAMEWORK- ECO SYSTEM 8

Hadoop Cluster Architecture – Hadoop Cluster Modules – Common Hadoop Shell Commands – Single Node Cluster – Multi- Node Cluster- Deployment in AWS —– Yarn Architecture – Work Flow – H-Base – Hive – Pig – SQoop – Flume – Apache Spark – Architecture – Principle and Working – Applications of Big Data- Case Study.

References:

Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Publisher, Publisher: Shroff/O'Reilly; Fourth edition (2015), ISBN-13: 978-9352130672.

Total Hours : 15

List of exercises:

1. Introduction to HDFS and Hadoop Ecosystem. Configuration and Installation of Hadoop 1.0 Single node with Name node and Data node.
2. Implementation and configuration of Hive in Hadoop ecosystem for querying.
3. Implementation of Pig using Hadoop Ecosystem for processing structured Data.
4. Implementation of Sqoop for transferring schema format to NOSQL format.
5. Configure Flume and Working flume for logdata.

6. Install HDFS 2.0 and explore YARN for scheduling.
7. Apache Spark Installation and implementation of simple programs in it.
8. Connect MongoDB with Hadoop as store data from MongoDB to HDFS.
9. Connect MYSQL with Hadoop and store data form MYSQL to HDFS
10. Work With RANGER and configure Hadoop for security features.
11. Install IBM BigInsights, hortonworks HDP on virtual machines
12. Working with AWS nodes. Creation of Virtual machines in AWS and Amazon S3.

Lab Hours: 30

Total Hours : 45

OUTCOMES:

Upon Completion of this course the student will be able to

- Demonstrate single node and multinode Hadoop 1.0 and 2.0 with installation and configuration.
- Compute the dataset with different tools in hadoop ecosystem.
- Analyze Hadoop Ecosystem using simple components like Pig, Hive and Sqoop.
- Exploring Apache Spark and analyzing the components in it.

ITCX119 FORENSIC TOOL KITS(LABORATORY)

L	T	P	C
0	0	3	1

OBJECTIVES:

- To understand Cyber Forensics, Digital evidence and Investigation process.
- To become familiar with Computer forensics toolkits (FTK).
- To analyze the components of the Encase forensic software environment, evidence and configuration files.
- To explore methods of data storage and forensic recovery using Access Data Software.

LIST OFEXERCISES:

1. Study of computer forensic toolkits like CyberCheck Suite (C-DAC), FTK, Helix, The Coroner's Toolkit (TCT), ProDiscover.
2. Working in Windows and Linux Environment: Study of various commands in Linux like Encryption and Decryption, message digest etc.
3. Exploring Encase software.
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.
9. Digital evidence imaging using R-Drive Imag, Drive Image Pro.

Total Hours : 45

OUTCOMES:

- To do the cross validation of computer forensic case data using Encase Access Data and computer forensic tools.
- Analyze the storage media forensics and email forensics.
- The ability to quantitatively assess and measure threats and forensic challenges to information assets.
- Analyze network forensic analysis using capturing and monitoring tools.
- To protect data assets against attacks from the Internet and investigate and mitigate data risk.

ITCX120	MONGODB FOR JAVA DEVELOPERS(LABORATORY)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To explore NoSQL database and learn installation of MongoDB.
- To practice hands-on session on Mongo Shell
- To learn the CURD operations in MongoDB.
- To acquire knowledge in sharding and replication.

List of exercises:

Introduction and Overview

Overview, Design Goals, the Mongo Shell, JSON Intro, Installing Tools, Overview of Blog Project. Maven, Spark and Free marker Intro.

Creating, Reading and Updating Data (CRUD)

Mongo Shell, Query Operators, Update Operators and a Few Commands

Schema Design

Patterns, Case Studies & Tradeoffs

Performance

Using Indexes, Monitoring and Understanding Performance. Performance in Sharded Environments/.

Aggregation Framework

Goals, the Use of the Pipeline, Comparison with SQL Facilities.

Application Engineering

Drivers, Impact of Replication and Sharding on Design and Development.

Case Studies

Total Hours : 45

OUTCOMES:

At the end of this MongoDB course you will be able to:

- Develop an expertise in writing Java applications using MongoDB
- Perform installation, configuration and maintenance of MongoDB environment
- Get hands-on experience in creating and managing different types of indexes in MongoDB for query execution
- Develop skillsets in processing huge amounts of data using MongoDB tools
- Proficiently store unstructured data in MongoDB
- Acquire in-depth understanding of managing DB Nodes, replica set & Master-Slave concepts.

ITCX121 GREEN COMPUTING L T P C
1 0 0 1

OBJECTIVES:

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To learn to minimize energy consumption.
- To examine technology that can reduce paper and other consumables usage.

MODULE I GREEN COMPUTING FUNDAMENTALS, ASSETS & MODELING 7

Green IT Fundamentals: Business, IT, Environment - Green IT Strategies: Drivers, Dimensions, Goals - Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture - Green Information Systems: Design and Development Models.

MODULE II GREEN IT FRAMEWORK & GREEN COMPLIANCE 8

Virtualizing of IT systems – Role of electric utilities, Telecommuting, Teleconferencing and

Teleporting – Going paperless - Materials recycling – Green Data center – Green Grid framework – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Total Hours : 15

TEXT BOOKS:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting , Emereo Publishing .ISBN-13: 978-1-9215-2344-1, 2014.

REFERENCES:

1. Ishfaq Ahmed & Sanjay Ranka, “Handbook of Energy Aware and Green Computing”, CRC Press, ISBN: 978-1-4665-0116-4, 2013.
2. Greg Schulz, “The Green and Virtual Data Center”, CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
3. Marty Poniatowski, “Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center”, Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

- Discuss Green Computing concepts, assets and business process management.
- Outline Green IT data center framework, Green compliance in IT systems.

ITCX122 XML TECHNOLOGIES(LABORATORY)

L	T	P	C
0	0	3	1

OBJECTIVES:

- To become familiar with various aspects of XML.
- Able to develop complex XML applications

LIST OF EXERCISES:

1. XML Document Creation.
2. Creating Inline Cascading Style Sheets, Embedded Cascading Style Sheets and External Cascading Style Sheets.
3. Render XML document with HTML in JavaScript.
4. Internal and External DTD Creation.
5. Importing and Exporting XML document in Database.
6. XSL Transformation- Displaying data with XSLT using XPath functions
7. Demonstrate X Query, X Link and XML Namespaces
8. XML Schema Creation- Working with simple types &Working with complex types
9. Parsing XML Document using SAX/DOM Parser.
10. Fetching data from XML using Java Applications.

Total Hours : 15

OUTCOMES:

On completing this course students will,

- Analyse the different scripting languages and learn to apply the same in different context in web technology
- Implement dynamic applications and apply it for real time problems.

ITCX123 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand big data analytics
- Discuss data analytic methods
- To learn technology and tools for analytics

MODULE I INTRODUCTION TO BIG DATA ANALYTICS 7

Big Data Overview – State of the Practice in Analytics – Data Analytics Lifecycle Overview – data analytics life cycle-discovery – Data preparation – Model planning – Model building – Communicate results – Operationalize.

MODULE II DATA ANALYTIC METHOD 8

Introduction to R - Exploratory data analysis – Statistical methods for evaluation – Clustering – k-means – Association rules.

MODULE III ADVANCED ANALYTICS 7

Regression – linear regression – Logistic regression – Classification – Data Visualization - Decision trees – Regression - Naives Bayes - Diagnostics of classifiers.

MODULE IV TIME SERIES AND TEXT ANALYSIS 8

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 TECHNOLOGY AND TOOLS 8

Analytics of unstructured data - The Hadoop Ecosystem – NoSQL - SQL Essentials - In-Database Text Analysis - Advanced SQL – MADlib.

MODULE VI RECOMMENDATION SYSTEM 7

Recommendation System and their Types – Content Based Recommendation System – Collaborative Recommendation System.

Total Hours : 45

TEXT BOOKS:

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Inc., Indianapolis, Indiana, 2015.
2. Rajat Mehta, "Big Data Analytics with Java", Packt Publishing Ltd, 2017.

REFERENCES:

1. Anil Maheshwari, " Data Analytics", Mc Graw Hill Education, 2017.
2. Vignesh Prajapati, "Big data analytics with R and Hadoop", Packet publishing, 2013.
3. Michael Minelli, Michele Chambers and Ambiga Dhiraj, "Big data, Big Analytics", John Wiley & Sons, Inc,2013.
4. Mike Barlow, "Real-time big data analytics-emerging architecture by, O'Reilly Media, First Edition, 2013.

OUTCOMES:

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

- Discuss the basics of big data analytics
- Explain the methods of analytics
- Describe the advanced analytics methods
- Perform time series and text mining
- Setup environment using technology and tools for analytics
- Carry out the analytic projects

ITCX124 PROGRAMMING IN SCALA(LABORATORY)

L	T	P	C
0	0	3	1

OBJECTIVES:

- To explore a multiparadigm programming language equivalent to java.
- To install and set up the environment to execute the scala programs.
- To develop simple scala programs and implement in the scala environment.
- To demonstrate the scala based web frameworks.

PRE-REQUISITES

1. Basic knowledge of Object Oriented Programming systems.
2. Fundamentals of Java Programming and Internet Programming.

LIST OF EXERCISES

1. Overview of Scala and environmental setup.
2. Creation of simple programs with basic syntax, variables and data types.
3. Implementation of class and extension of class and objects.
4. Implementation of classes using access modifiers and operators.
5. Implementation of looping statements and branching statements.
6. Implementation of programs in Arrays and Collections.
7. Implementation of strings, traits, pattern matching.
8. Implementation of pattern matching with extractors.
9. Program with regular expressions and exceptional handling.
10. A case study of different web frameworks with scala.

Total Hours : 45

SOFTWARE REQUIRED

- Java Environment - Java SDK version 1.8.0_31
- Scala – Code Runner Version- 2.11.5.

OUTCOMES:

On completion of the programme students will be able to:

- Install and set the environment to run scala programs.
- Develop and implement scala programs with arrays, classes and objects.
- Implement pattern matching based programs
- Explore scale based web frameworks

ITCX125 R PROGRAMMING (LABORATORY)

L	T	P	C
1	0	2	2

OBJECTIVES:

- To understand the fundamentals of R programming.
- To analyze the data and draw graph

MODULE I INTRODUCTION TO R PROGRAMMING 7

Introduction – R Programming Structures - Doing Math and Simulations in R

MODULE II DATA ANALYSIS AND DATA MINING 8

Text mining and network analysis of Digital Libraries in R – Recommender Systems in R – Selecting best features for predicting Bank Loan Default.

LIST OF EXERCISE:

1. Store data in textual and binary format.
2. Subsetting R objects
3. Vectorized Matrix Operation
4. Text mining
5. Recommender System
6. Crime data analysis
7. Social network analysis

Total Hours : 45

Text Book:

1. Yanchang Zhao, Yonghua Cen, “Data Mining Applications with R”, Academic Press, 2014.
2. Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design, “, No Starch Press, 2011.

OUTCOMES:

On completion of the programme students will be able to:

- Develop a simulation model in R programming.
- Analyze the data and perform knowledge mining.

ITCX126 VIRTUAL REALITY L T P C
2 0 2 3

OBJECTIVES:

- To make students know the basic concept and framework of virtual reality.
- To study of virtual reality systems, transformations, graphical rendering, human vision.
- To discuss VR system framework and development tools.
- To design a virtual environment and compelling virtual reality experience.

THEORY COMPONENT

MODULE I INTRODUCTION TO VIRTUAL REALITY 10

Introduction – Goals and VR definitions – History of VR and AR – The Graphics Pipeline and OpenGL: Overview and Transformations – Rotation, Translation, Scaling, Modelview matrix, and Projection matrix – Lighting and Shading with GLSL – Stereo Rendering - Human visual system

MODULE II TRACKING SYSTEMS &VR INTERFACES 10

Orientation tracking – Tilt drift correction – Yaw drift correction – Tracking with a camera – Perspective n-point problem – Filtering – Lighthouse approach - Evaluation of VR Systems – Interactive techniques in VR – Body track – Hand gesture

MODULE III VR DEVELOPMENT TOOLS AND FRAMEWORKS 10

Frameworks of Software Development Tools in VR – X3D standard – Vega – MultigEN – VR toolkits – VRML Programming – Augmented reality system - VR technology in Film & TV production – VR technology in physical exercises and games – Demonstration of Digital Entertainment by VR – Emerging Virtual Reality Applications.

LAB COMPONENT - LIST OFEXERCISES

1. Hello, Web GL!
2. Lighting and Shading with GLSL
3. Stereo Rendering, Depth of Field and Anaglyph
4. Build your own HMD
5. Orientation Tracking with IMUs Arduino Programming
6. Pose Tracking

7. VRML Programming
8. Work on augmented reality
9. Demo on Digital Entertainment by VR
10. Case study - Virtual Reality Applications

L: 30; P: 15 Total Hours : 45

REFERENCES:

1. John Vince, “Virtual Reality Systems”, Pearson Education, First edition, 2007.
2. Burdea, G.C. and P. Coiffet, “Virtual Reality Technology”, Second edition, Wiley-IEEE Press, 2003.
3. Sherman, W.R. & A. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann, San Francisco, CA, 2003.
4. Alan B. Craig, William R. Sherman, and Jeffrey D. Will, “Developing Virtual Reality Applications-Foundations of Effective Design”, Morgan Kaufmann Publisher, 2012.
5. George Mather, “Foundations of Sensation and Perception”, Psychology Press; Second edition, 2009.
6. Peter Shirley, Michael Ashikhmin, and Steve Marschner, “Fundamentals of Computer Graphics”, A K Peters/CRC Press; Third edition, 2009.

OUTCOMES:

- Provides students the fundamental knowledge of virtual reality required for their professional career in this field, and applied to various applications such as digital entertainment.
- Apply visual rendering and audio in VR systems in real time standards.
- Design of VR interfaces using interactive techniques.
- Analyze frameworks of Software Development & modeling Tools in VR.

ITCX127 SOFTWARE QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is to enable the students:

- To understand the fundamental concepts of quality management.
- To acquire the knowledge of understanding the "widely-used" quality analysis tools and techniques.
- To have the exposure about software quality assurance, quality measures, and quality control.
- To introduce philosophies and strategies to quality related issues.

MODULE I INTRODUCTION 7

Quality Concepts and Perspectives - Assuring Software Quality Assurance – Software Quality Assurance Planning.

MODULE II SOFTWARE QUALITY MEASUREMENTS 7

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 8

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 8

Product Quality Metrics: Defect Density-Customer Problems Metric- Customer Satisfaction 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 8

Life Cycle Process – Model Based Software Architectures – Workflow of The Process – Checkpoint of The Process – Iterative Process Planning – Project Organizations And Responsibilities – Process Automation.

MODULE VI SOFTWARE RELIABILITY AND PROCESS IMPROVEMENT 7

Definition and Measurement – Measurement based Assurance – Software Process Improvement and Capability Determination.

Total Hours : 45

TEXT BOOKS:

1. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, 2016.

OUTCOMES:

Upon completion of the course, the student should be able to

- Describe software quality assurance.
- Understand the measurement theory concept.
- Choose the suitable software quality model for the given software project.
- Identify various software quality metrics.
- Understand management problems, general solutions, technologies and standards.
- Describe software process improvement.

ITCX128 CLOUD FORENSICS L T P C
3 0 0 3

OBJECTIVES:

- Gain knowledge on fundamental concepts of cloud forensics
- Apply appropriate skills and knowledge in solving cloud forensics investigation.
- Apply theoretical and practical knowledge in forensic computing into the future.
- Familiarize the basics of Digital Forensics.
- Analyze the legal, ethical and professional issues in Cyber Crime.
- Know the technological aspects of Incident Response.

MODULE I INTRODUCTION TO CLOUD FORENSICS 9

History of Forensics – Cloud Forensic Flaws and Risks – Rules of Cloud Forensics – Legal issues – Digital Forensic Principles – Digital Environments – Digital Forensic Methodologies - Forensics Software and Hardware tools.

MODULE II AN OVERVIEW OF CLOUD FORENSICS INVESTIGATION 8

Router Forensics and Network Forensics – An overview of Routers – Hacking Routers – Investigating Routers – Investigating Wireless Attacks – Basics of wireless – Wireless Penetration Testing – Direct Connections to Wireless Access Point – Wireless Connect to a Wireless Access Point.

MODULE III DIGITAL FORENSICS 9

Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination - Seven element security model-developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context.

MODULE IV NETWORK FORENSICS 6

Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing - Internet Fraud.

MODULE V SYSTEMS INVESTIGATION AND ETHICAL ISSUES 6

Data Analysis Techniques - Investigating Live Systems (Windows &Unix) - Investigating Hacker Tools - Ethical Issues – Cybercrime.

MODULE VI INCIDENT AND INCIDENT RESPONSE 7

Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response Phase after detection of an incident.

Total Hours : 45

REFERENCES:

1. Anthony Reyes, Jack Wiles, “Cybercrime and Digital Forenscis”, Elsevier Publications, 2007.
2. John Sammons, “The Basics of Digital Forensics”, Elsevier, 2012.
3. Linda Volonins, Reynalds Anzaldua, “Computer Forensics for dummies”, Wiley Publishing 2008.
4. Norbert Zaenglein, “Disk Detective: Secret You Must Know to Recover Information From a Computer”, Paladin Press, 2000.
5. Bill Nelson,Amelia Philips and Christopher Steuart, “Guide to computer forensics and investigations”, course technology, Cengage Learning; 4thedition, ISBN: 1- 435-49883-6, 2009.
6. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGrawHill, 2006.

ITCX129 NETWORKING SIMULATORS(LABORATORY)

L	T	P	C
0	0	3	1

OBJECTIVES:

- Introduce various wireless systems and standards and their basic operation cases.
- Learn to simulate wireless networks and analyze the simulation results.

LIST OF EXERCISES

Experiments using NS2, Wireshark and Packet tracer.

1. Wireless Access Point - configuring and enabling security.
2. Wi-Fi based Data Acquisition.
3. Routing protocols for IP network using routers.
4. Configuration of VLAN using switches.
5. Signaling in wireless networks (RTS, CTS, DATA and ACK)
6. Configure AODV Routing Protocol.
7. Configure DSR Routing Protocol.
8. RTP protocol of VoIP.
9. Implementation of network security algorithms.
10. Network performance analysis.

Total Hours : 45

OUTCOMES:

On completion of the course students will be able to:

- Create wireless network environment and configure virtual LAN.
- Develop various wireless network applications.
- Demonstrate different wireless network protocols.
- Identify suitable network security algorithms for a given scenario.
- Assess the performance of wireless network using packet sniffer.

ITCX130 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

OBJECTIVES:

- Knowing the real time information about business field strategies and business process of an enterprise.
- Understand and how to access information and provide services through an intuitive and integrated interface, and ultimately aims to: Improve Service Experience, Enhance Competitiveness, Modernize Business Processes and Systems, Automate Business Solutions, Increase Operating Efficiency and Provide Access to Standardized College Data.
- To understand the key implementationissues.
- Toknowthebusinessmodulesandappreciatethecurrentandfuturetrends.
- To be aware of some popular products available inmarket.
- Familiar the current and future emerging trends in erp developments.

MODULE I ERP AND TECHNOLOGY 9

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERPandRelated Technologies, Business Process Reengineering (BPR),Data Warehousing,DataMining,OLAP,SCM, CRM and Product life Cycle management.

MODULE II ERPIMPLEMENTATION 9

ERP Implementation Challenges - Lifecycle, Implementation Methodology, Package selection, Requirements Definition – Methodology Vendors, Consultants and Users,– Data Migration, People Organization in implementation-Consultants, Vendors and Employees, ProjectManagementand Monitoring.

MODULE III ERP INACTION 6

Operation and Maintenance of the ERPSystem,MeasuringthePerformanceoftheERPSystem,MaximizingtheERPSystem. Organizational and Industrial impact, Success and Failure factors of and ERP Implementation

MODULE IV THE BUSINESSMODULES 7

BusinessmodulesinanERPPackage,Finance,Manufacturing,HumanResources, MaterialsManagement,Marketing, Total QualityManagement,Sales, Distribution and Service.

MODULE V THE ERPMARKET 8

Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc –SSA Global – Lawson Software.

MODULE VI ERP – PRESENT AND FUTURE 6

TurboChargetheERPSystem - EIA,ERPande-Commerce - ERP II -ERPandInternet - FutureDirections and Trends in ERP.

Total Hours : 45

TEXTBOOKS:

1. AlexisLeon,“ERPDemystified”,TataMcGrawHill,NewDelhi,2000.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCES:

1. VinodKumarGargandVenkitakrishnanNK,“EnterpriseResourcePlanning– Concepts and Practice”, PHI, New Delhi,2003.
2. JosephABrady,EllenFMonk,BretWagner,“ConceptsinEnterpriseResourcePlanning” ,Thompson Course Technology, USA,2001.

OUTCOMES:

Uponcompletionofthiscoursestudentsshouldbeableto:

- Understandhowbusinessprocessesaremapped(translated)intoenterprisesystems oftwareandhowmanagerialdecisionsintegrateacrossdisciplines.
- Understand and be able to articulate the life cycle stages of any ERP implementation.
  Developworkingknowledgeofenterprisesystemmodulestoenableefficientnavigation and information access formanagement.
- Differentiate enterprise system transactions, queries, and reports within a manager’sroleanddevelopcompetenceintransformingrawdatainto managementinformation.
- Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods.
- Understand key differences between the major ERP applications (such as SAP AG, and Oracle/PeopleSoft) and issues specific to these applications their configuration and management.
- Synthesize prior theoretical and experiential knowledge in IT development and project management with the current literature on Enterprise System development.

ITCX132	ARTIFICIAL INTELLIGENCE FOR DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students

- To understand the evolution and significance of Artificial Intelligence.
- To identify and explore tools and methods to implement Data Science.
- To explore the concepts of machine learning and deep learning.
- To explore the frameworks of AI for data science
- To develop and implement applications and tools based on ontology.
- To understand the problems and solve the case studies using AI.

Prerequisite: Machine Learning, Artificial Intelligence.

MODULE I INTRODUCTION to ARTIFICIAL INTELLIGENCE(AI) 9

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 8

Standard Genetic Algorithms (GA) – Implementation of GA's in Julia – Main variants of GA's- GA frameworks.

MODULE V BUILDING OPTIMIZER BASED ON PARTICLE SWARM OPTIMIZATION 7

Standard Particle Swarm Optimization (PSO) algorithm's – Implementation of PSO – PSO frameworks – Variants in PSO.

MODULE VI ADVANCED AI FRAMEWORKS IN DATA SCIENCE 7

Convolutional Neural Networks- Recurrent Neural Networks-Extreme Learning Machines – Capsule Networks – Fuzzy logic – Fuzzy Interface systems.

Total: 45 Hours

TEXT BOOK:

1. Yunus Emrah Bulut, Zacharias Voulgaris, “AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond”,Technics Publications, 2018, ISBN: 9781634624114.
2. Shai Shalev-Shwartz and Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2014.
3. Kevin Knight and Elaine Rich, “Artificial Intelligence”, Third Edition, July 2017.

OUTCOMES:

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

- Explore fundamentals of Artificial intelligence and data science.
- Understand the concepts of Deep learning and tools.
- Building Deep learning frameworks using tensor flow, MX net and Keras.
- Building DL frameworks using genetic algorithm and PSO.
- Have hands on experience on various popular programming languages of DL.
- Explore advanced frameworks of AI for data science.

ITCX133 BLOCKCHAIN TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the problems solved by Blockchain.
- To learn how technology can make institutions faster and less expensive.
- To analyse how Blockchain increase security for transactions and contracts.
- To gain knowledge about bitcoins and problems in bitcoins.
- To understand about cryptographic hash functions.

MODULE I INTRODUCTION TO BLOCKCHAIN 08

Introduction- Replacing institutions with technology – New technological paradigm Security and privacy – Crptography – Blockchain future – finance, Governance, crowdfunding, Insurance.

MODULE II PRINCIPLES OF BLOCKCHAIN 08

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 08

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 07

Mining a Bitcoin block by hand- Bitcoin history – story of Satoshi – Bitcoin Scalability problem – wait times –restricted block size.

MODULE V BLOCKCHAIN CATEGORIES 08

Blockchain categories- Challenges of Blockchain technology – Introduction to Blockchain programming – Potential of Blockchain – Governments and Blockchain.

MODULE VI BLOCKCHAIN TECHNOLOGIES 06

Bitcoin cash – Litecoin – Privacy coins – Dash – Hyperledger – IOTA – Ripple.

Total Hours : 45

TEXTBOOK:

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. Mark Gates, “Blockchain: Ultimate Guide to Understanding Blockchain, Bitcoin, Cryptocurrencies, Smart Contracts and the Future of Money”, CreateSpace Independent Publishing Platform, 2017.
2. Jeff Reed, “Blockchain: The Essential Guide to Understanding the Blockchain Revolution”, CreateSpace Independent Publishing Platform, 2016.

OUTCOMES:

- Discuss about applying Blockchain in various institutions.
- Explain the significance of digital currencies like bitcoin.
- Analyze the security and privacy issues of transactions & contracts.
- Discuss about the application of Blockchain technology in real world applications.
- Analyze the challenges and potential bottlenecks of Blockchain technology.

ECCX 70 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

PREREQUISITES:

- Basics of electronic components, circuits, processors,
- Basics of analog and digital communication, wireless communication

MODULE I INTRODUCTION TO EMBEDDED SYSTEM 8

Introduction Embedded System -characteristics - challenges- Application areas - Real Time Examples – Embedded system design process - requirements analysis- specifications- design methodologies.

MODULE II EMBEDDED SYSTEM HARDWARE DESIGN 7

Internal processor design: ALU – registers – control unit - clock – on chip memory – processor I/O – interrupts – processor buses – processor performance.

MODULE III DESIGN AND DEVELOPMENT OF EMBEDDED SOFTWARE 8

Host and target machines - compilation process – libraries -Linkers / Locators for Embedded Software – Debugging techniques – Integrated Development Environment – Introduction to Embedded C.

MODULE IV PROCESSES AND OPERATING SYSTEMS 7

Tasks and processes - process timing requirements- real-time operating systems- preemptive execution- context switching- scheduling processes- priority scheduling- inter-process communication- shared-memory systems- message passing.

MODULE V NETWORKS FOR EMBEDDED SYSTEMS 8

Multiprocessor systems, distributed embedded systems, CAN bus, I2C bus, multiprocessor system-on-chip (MPSoC), accelerators – Introduction to IoT.

MODULE VI EMBEDDED SYSTEM APPLICATION 7

Application specific embedded system – case study: Embedded systems in Automobile – Smart card – Digital Camera – Smart Phone.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill, 2009.
3. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, The publisher, Paul Temme, 2011.

REFERENCES:

1. Sriram V Iyer and Pankaj Gupta , “Embedded Real time Systems Programming”, Tata McGraw-Hill, 2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMP Books, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

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

- Identify requirements analysis and specifications to design the embedded system
- Choose the right platform for designing an embedded system
- Implement debugging techniques in embedded system design
- Explore different scheduling mechanism in RTOS
- Illustrate the concepts of embedded networking
- Analyze different domain specific applications in embedded systems.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01 FUNDAMENTALS OF ENGINEERING MATERIALS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To familiarize students with basic ideas of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To help students acquire the properties and applications of magnetic materials and dielectric materials.
- To familiarize students with basics ideas about the properties of dielectric and its applications
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentrations, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field -Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in FERAM - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton –Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application -Giant Magneto-resistance effect(GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials –quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, grapheme - nanocomposites – applications.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L : 30 periods, P: 30 periods, Total: 60 periods

REFERENCES:

1. William D.Callister, Material Science and Engineering, Wiley Publications, 2006.
2. Raghavan, V., Materials Science and Engineering, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab.M.A, Solid State Physics: Structure and Properties of Materials,Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
2. Pillai, S.O., Solid State Physics, New Age International, New Delhi, 2005.
3. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- Differentiate between the properties of the nanomaterials compared to bulk materials.
- Comprehend the significance of properties of magnetic materials and derive these properties from synthesized materials.
- Apply the concepts of conducting and semiconducting materials for solid state devices.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02 HEAT AND THERMODYNAMICS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT 10

Definition of temperature, thermal and thermodynamic equilibrium- relationship between temperature and kinetic energy- definition of solid, liquid, gas- Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- Microscopic model of ideal gas- equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION 10

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a bad conductor – Lee's disc method – conduction of heat through compound media-radiation – Planck's law blackbody radiation – Wien's law – Stefan's law – Newton's law of cooling from Stefan's law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS 10

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics -Heat engine – Carnot's engine – Carnot's theorem – Internal combustion engines – petrol and diesel engines(qualitative) – Entropy – entropy and available energy – temperature – entropy diagram for Carnot's cycle - Third Law of thermodynamics(qualitative).

L : 30 periods

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule's calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve- Newton's law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a bad conductor-Lee's disc method
5. Determination of thermal conductivity of a good conductor-Forbe's method

P: 30 periods

Total: 60 periods

REFERENCES :

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi., 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”,Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- Understand the concepts of heat and its properties.
- Comprehend the ideas governing the conduction and radiation processes.
- Understand and apply the ideas of laws of thermodynamics in thermodynamic systems.
- Perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS 10

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials –quantum well, quantum wire, quantum dot- nanoporous materials-zeolite, mesoporous materials, carbon nanotubes, graphene- nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES 12

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling-sol-gel approach-hydrothermal method-precipitation method-spray pyrolysis-spin coating-self assembled monolayer (SAM)-Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy –confocal microscopy- high resolution Scanning electron microscope (HRSEM)- high resolution Transmission electron microscope (HRTEM)-Atomic force microscope-Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION 8

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography-nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

L : 30 periods

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.
2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

P: 30 period

Total: 60 periods

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience, Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

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

- Understand the importance and basic concepts of the nanomaterials.
- Comprehend the imaging techniques for nanomaterials.
- Illustrate the various nanofabrication techniques.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04 LASERS AND THEIR APPLICATIONS

L	T	P	C
2	0	2	3

OBJECTIVES

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY 8

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS 8

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS 8

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION6

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

L : 30 periods

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

P: 30 periods

Total: 60 periods

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. &Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

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

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength
- To measure the loss of information involved in fibre optic communication
- To correlate the results for application.

PHCX 05 **MATERIALS SCIENCE** **L T P C**
2 0 2 3

OBJECTIVES

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide a basis for understanding properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 8

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 7

Introduction to magnetic materials & origin of magnetic moment - Different types of magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 8

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L : 30 periods, P: 30 periods

Total: 60 periods

REFERENCES

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES

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

- Gain knowledge about fundamentals of conducting and semiconducting materials
- Understand the concepts and applications of Dielectric, Magnetic materials
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06 NON-DESTRUCTIVE TESTING L T P C
2 0 2 3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD 10

Ultrasonic Testing- Principle of operations- types of sound waves -types of Transducers-transmission and pulse-echo method- straight beam and angle beam, instrumentation- calibration methods-ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction-thickness determination-, advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD 10

Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Equipment-Exposure charts-Types of films-Fluoroscopy- Xero-Radiography –Limitations-Gamma radiography-Equipment, radiation sources- method of generation- film processing- interpretations of radiography-safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES 10

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants-developers- advantages and disadvantages of various methods- Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing- Principle-magnetizing technique-procedure –equipment-Interpretation and evaluation of test indications-.applications and limitations-demagnetization.

L : 30 periods

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.
3. Inspection on non magnetic materials by eddy current method.

4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector- Inspection of defects.
9. Demonstration of Radiographic inspection.

P: 30 periods

Total: 60 periods

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix.,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- Illustrate the ultrasonic inspection methods of NDT.
- Understand the basic concept of radiographic inspection method.
- Test the surfaces by the various surface NDT techniques.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07 PROPERTIES OF MATTER AND ACOUSTICS L T P C
2 0 2 3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY 8

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY 8

Viscosity- Newton’s formula for viscous flow- Streamline and turbulent motion- Reynolds number - Poiseuille's formula- Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements- Viscometer- Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING 7

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials-vibration and noise control systems for buildings.

MODULUE IV PHOTOELASTICITY 7

Polarization- double refraction-Theory of Plane, Circularly and Elliptically polarized light- Quarter wave plate and half wave plate- photo elasticity- Theory of photo-elasticity- Stress optic relations- model materials-analysis techniques- Photo elastic

bench.- Three dimensional photo elasticity-Digital photo elasticity- Photo elastic coatings.

L : 30 periods

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

P: 30 periods

Total: 60 periods

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- Understand the basic concepts of the elasticity of materials.
- Comprehend the concepts of viscosity of liquid and measurement.
- Demonstrate the acoustical aspects of building and its importance in construction.
- Illustrate the fundamental concept of photo elasticity and its use for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY 8

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES 8

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel (qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES 6

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method-Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS 8

Definition of Refrigeration and Air-Conditioning - Types of**Refrigeration Systems-** Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and

food chain -**Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

L : 30 periods

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
4. Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

P: 30 periods

Total: 60 periods

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi,2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal &Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- Demonstrate the various NDT techniques and its importance.
- Illustrate the low temperature systems and its applications.

PHCX 09 SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS 8

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – 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.

MODULE II OPTOELECTRONIC DEVICES 7

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS 7

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS 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.

L : 30 periods

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

P: 30 periods

Total: 60 periods

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles& Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- Understand the principles of Physics behind semiconductor devices.
- Choose the correct semiconductors for electronic devices and display.
- Differentiate the working principle of LED and Diode Laser.
- Apply the knowledge of modulation of light for different types of optical modulators.
- Select suitable photodetectors for different types of applications.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01 ANALYTICAL INSTRUMENTATION L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES 7

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY 8

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY 8

Absorptionspectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS 7

Principle, instrumentation and applications: Thermogravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

L: 30 periods

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations
2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

P:30 periods

Total: 60 periods

REFERENCES

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02 CORROSION AND ITS CONTROL L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coatings

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels- constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS **7**

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

L : 30 periods

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

P:30 periods

Total: 60 periods

REFERENCES

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES

The students will be able to

- explain the mechanism, compare and enumerate the factors affecting corrosion
- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03 ELECTRICAL MATERIALS AND BATTERIES L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS 8

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS 7

Conductors**:** Silver, Copper, Gold, Aluminum **–** Semiconductors: Germanium, Silicon, Gallium Arsenic **–** Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers **–** Magnetic Materials**:** ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES 7

Electrochemical and electrolytic cell – batteries**:** types (primary, secondary and flow cell) – primary batteries**:**dry cells, alkaline batteries – secondary batteries**:** nickel-cadmium cell – lead acid storage cell, lithium battery**:** primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS 8

Difference between batteries and fuel cells - chemistry of fuel cells - types 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).

L:30 periods

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

P:30 periods

Total: 60 periods

REFERENCES

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput, A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04 ENGINEERING MATERIALS L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES 8

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS 8

Introduction - classification of adhesives –advantage –limitation of adhesive bonding –development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS 7

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash

point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

L:30periods

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

P:30 periods

Total: 60 periods

REFERENCES

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05 FUELS AND COMBUSTION L T P C
2 0 2 3

OBJECTIVES

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS 7

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS 8

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION 8

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS 7

Friction and wear – lubricants: definition, functions and mechanism of lubrication (thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of

lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

L:30 periods

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine - Demonstration

P:30 periods

Total: 60 periods

REFERENCES

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06 FUNDAMENTALS OF PHYSICAL CHEMISTRY L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS 8

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS 8

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS 8

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE 6

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

L:30 periods

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

P:30 periods

Total: 60 periods

REFERENCES

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07 GREEN TECHNOLOGY L T P C

2 0 2 3

OBJECTIVES

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL 7

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION 8

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS 7

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES 8

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

L:30 periods

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic chemicals.
2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

P:30 periods

Total: 60 periods

REFERENCES

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08 ORGANIC CHEMISTRY OF BIOMOLECULES L T P C
2 0 2 3

OBJECTIVES

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY 8

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS 7

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS 7

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS 8

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

L: 30 periods

PRACTICALS

1. Qualitative tests to identify carbohydrates.
2. Quantitative estimation of carbohydrates.

3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

P:30 periods

Total: 60 periods

REFERENCES

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09 POLYMER SCIENCE AND TECHNOLOGY L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS 8

Definitions**:** monomer, polymer, functionality, degree of polymerization – classification of polymers**:** source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer**:** number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS 8

Preparation, properties and applications **:** LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP 7

Thermoset resins **:** phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers **:** vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics**:** glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

L: 30 periods

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

P:30 periods

Total: 60 periods

REFERENCES

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES

The student will be able to

- classify various polymers, name the polymers and types of polymerization reactions, calculate molecular weight of polymers,
- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses
(to be offered in IVSemester)

MACX 01	DISCRETE MATHEMATICS AND GRAPH THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

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 7+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 FUNCTIONS 7+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 IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

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.

OUTCOMES:

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

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

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

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+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 8+2

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

MODULE IV SAMPLING AND ESTIMATION 7+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 8+2

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.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”,Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03 RANDOM PROCESSES L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+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 One dimensional Random variable and Probability Distribution functions 7+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 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

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, 2008.
2 Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3 S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1 Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2 Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+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 8+2

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 8+2

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 7+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 INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+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, 2007.
2. C.F.Gerald, 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, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

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

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

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

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

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

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. “A Modern Introduction to Probability and Statistics” Springer, 2nd Edition.
2. Chin Long chiang “Statistical Methods of Analysis “World Scientific Books, 2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

- M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
- Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING L T P C
2 0 0 2

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, "An introduction to Mathematical modelling", Heaven for Books.com
2. Alfio Quarteroni, "Mathematical models in science and engineering", Notices of AMS
3. J.N. Kapur, "Mathematical models in Biology and Medicine", Affiliated East-West Press Private Limited, New Delhi, 1992.

OUTCOMES:

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

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**
2 0 0 2

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree- spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets- network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

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
3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

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

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

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) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

- Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
- Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

- Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
- Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY. L T P C
2 0 0 2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3 SOCIOLOGY OF INDIAN SOCIETY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, 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 IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization;

Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on

social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II
(To be offered in IV Semester)

SSCXO4	ECONOMICS OF SUSTAINABLE DEVELOPMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

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, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

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 **7**

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; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- 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; Industrial conflict- strike , lockout and trade unions.

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 8

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.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS L T P C
2 0 0 2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 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.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.
2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rdedn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

GECX101	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of various environmental hazards and its management measures.
- To give exposure on the natural disasters causes and prevention strategies.
- To give exposure on various man-made disasters causes and prevention strategies.
- To make them understand the different segments of disaster management.
- To introduce the concept of different relief measures to be adopted in the time of disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness

plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA 8

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

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

- Describe the origin, changes and management of environmental hazards.
- Develop the knowledge on natural disasters.
- Develop the knowledge on man-made disasters.
- Discuss the different segments of disaster management.
- Explain the concept of different disaster relief measures.
- Achieve sufficient knowledge on the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs- Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss

Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd.,Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- Apply the various statistical tools and approaches for Quality control.
- Achieve continuous process improvement through TQM.

GECX103	ENERGY STUDIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 ROBOTICS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY 8

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN 8

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

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

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- • Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX 108 PLANT ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto,2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

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

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key

Infrastructure -Federated Identity Management - Web Security Considerations - Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions such as PGP,SSL, IPSec, etc.
- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cybersecurity.
- TounderstandCyberFraudsandAbuseanditsSecurityMeasures.
- To know the technological aspects of CyberSecurity.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

SecurityproblemincomputingвЂ“CryptographyBasicsвЂ“HistoryofEncryptionвЂ“ Modern Methods вЂ“ Legitimate versus Fraudulent Encryption methodsвЂ“ EncryptionusedinInternet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security вЂ“ Cybercriminals вЂ“ Classifications of Cybercrimes вЂ“ Email Spoofing вЂ“ Spamming вЂ“ Cyber defamation вЂ“ Internet Time Theft вЂ“ Forgery вЂ“ Web jacking вЂ“ Hacking вЂ“ Online Frauds вЂ“ Software Piracy вЂ“ Mail Bombs вЂ“ Password Sniffing вЂ“ Cyberoffenses вЂ“ Categories вЂ“ Planning the attacks вЂ“ Cyberstalking вЂ“ Cybercafe and Cybercrimes вЂ“ Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices вЂ“ Trends in Mobility вЂ“ Credit card frauds in Mobile and Wireless Computing вЂ“ Security Challenges вЂ“ Authentication Service Security вЂ“ Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers вЂ“ Phishing вЂ“ Password Cracking вЂ“ Keyloggers and Spywares вЂ“ Virus and Worms вЂ“ Trojan Horses and Backdoors вЂ“ Steganography вЂ“ DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies вЂ“ Passwords вЂ“ Internet Use вЂ“ Email Usage вЂ“ Installing/ Uninstalling Software вЂ“ Instant Messaging вЂ“ Defining System Administrative Policies вЂ“ Defining Access Control Developmental Policies Standards, Guidelines and Procedures вЂ“ Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.
2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education,2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”,3rdEdition, Pearson Education,2003.
2. WilliamStallings,“CryptographyandNetworkSecurity–Principlesand Practices”, 3rd Edition, Pearson Education,2003.
3. AtulKahate,“CryptographyandNetworkSecurity”,TataMcGrawHill,2000.

OUTCOMES:

Uponcompletionofthiscourse, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

- The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic materialDescribe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management-Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.

A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.

3. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

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

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart carefully maintaining their vehicle and can increase driving safety.

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- Analyze the causes and remedies for fault in transmission and drive line systems.
- Analyze the causes and remedies of steering and suspension systems.
- Analyze the causes and remedies of brake system.
- Demonstrate the procedure for wheel alignment and wheel balanced.

GECX117 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform,Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS : 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge on the concepts of sustainable development and fundamentals of socio economic systems.
- To understand the basics of green building and frame work for the attainment of sustainability.
- To enhance the student's interest in the design of green building and energy efficient measures in a buildings.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development- Environment and development linkages - Globalisation and environment- Population, poverty and pollution- global, regional and local environment issues- Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth-Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation- Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

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

- explain the objective, need for the sustainability and also the link between the globalization and environment.
- Address the economic, environmental, and social concerns in the sustainable development.
- Acquire knowledge on the performance indicators, constraints and barrier for sustainability.
- Explain the relationship between sustainability and emergence of green building practices.
- Recommend relevant energy conservation measures in a building
- describe the elements in green building design and suggest ideas for attainting sustainability in building.

GECX202 APPROPRIATE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of appropriate technology and expose the students to the basics of financial analysis and energy fundamentals.
- To create awareness on the appropriate technology with relevant to building design, water, sanitation and waste management.
- To enhance student's interest in energy efficient techniques and impart knowledge on relevant policies.

MODULE I BASICS CONCEPTS **7**

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN **7**

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT **7**

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT **8**

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES **8**

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY **8**

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

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

- describe about the tools, choices of appropriate technology along with concepts of energy fundamentals
- conceptualize the techniques to be adopted in building design for saving energy and water.
- acquire knowledge about the techniques for water, health and sanitation management
- explain the classification, collection dispose and recycling systems adopted in waste management.
- elucidate the concepts of green building and renewable energy sources.
- express the polices relevant to technology and recommend an appropriate technology for an sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY L T P C
3 0 0 3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT 7

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING 7

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION 8

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY 8

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING 8

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks,

and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

- Formulate a real life situation as an optimization the problem.
- Identify the appropriate solution methodology and provide a solution

GECX 207 MATLAB SIMULATION L T P C
3 0 0 3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1st order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2nd order and higher ODEs to systems of 1st order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples-Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms-Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons,2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”TataMcGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems",CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

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

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National,

International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, "Usability Engineering: Process, Products, and Examples", Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System

Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION **7**

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE **7**

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.
2. Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.
3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.
4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.
5. Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 ADVANCED MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213 NATIONAL SERVICE SCHEME

L	T	P	C
2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

- To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- To develop certain basic skills for personality development through community development.
- Understand the community in which they work and their relation
- Identify the needs and problems of the community and involve them in problem-solving and
- Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme-The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution-Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

- National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
- National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
- Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise',
6. Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE AND POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications & Table of Offences and Punishments Asia Law House; 15th edition (2014)
2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the analog and digital modulation techniques.
- To elaborate the working of communication receivers in the presence of noise.
- To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data,Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A.Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition, McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, "Principles of Communication Systems" 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, "An Introduction To Analog And Digital Communications", 1st Edition, Wiley India, 2010.
3. Simon Haykin , "Communications Systems" 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, "Analog and Digital Communications" 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

- Identify various communication systems and the corresponding modulation schemes.
- Predict the characteristics of various analog and digital modulation schemes.
- Interpret the effect of noise and bandwidth in a communication systems
- Apply the Nyquist criteria for a given baseband signals.
- Evaluate the performance of communication receivers.
- Demonstrate the applications of common communication systems.

GECX 217 LEAN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

The objective of the Course to make the student know about

- The basics of leanproduction management,
- How Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **7**

Lean production – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and

the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications. Sustaining improvement and change, auditing, follow-up actions.

MODULE VI **7**

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

Total Hours –45

TEXT BOOKS:

1. The Toyota Way Field book, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings athttp://www.leanconstruction.org/readings.htm
2. Hopp,W.J.,andSpearman,M.L.(2011).FactoryPhysics,ThirdEdition, WavelandPress,LongGrove,Il. 720pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 SPATIAL DATA MODELING AND ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the fundamental representation and analysis of geospatial phenomena and provides the various methods and algorithms used in GIS analysis.
- To focus in terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS 8

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), Geospatial Data Science Techniques and Applications, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), Hierarchical Modeling and Analysis for Spatial Data, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

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

- apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- employ the spatial tools to make simulations and predictions of real life phenomena.
- integrate and develop models with geospatial data through GIS.
- evaluate models in terms of accuracy, sensitivity, and uncertainty.
- perform a system-based approach for problem solving, with an emphasis on sustainability.
- execute the hydrological, erosion and environmental modeling through GIS.

GECX 219	ADVANCED ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an entrepreneurial mindset.
- To learn the tools and methods for achieving sustainable growth.
- To explore various funds for a business and to get know about importance of a good team.
- To select public image branding and examine all channel types.
- To identify technology needs and establish key metrics to measure progress the business.
- To know about legal issues, regulations of starting and operating a venture and capstone presentation on practice venture.

Course Pre-requisites Completion of Social Entrepreneurship CourseAccess to Learnwise Platform

MODULE I ENTREPRENEURSHIP BASICS & REFINING BUSINESS MODEL 8

EntrepreneurshipBasics - Recap of Key Concepts, Introduction to First Venture, Recap of idea selection and Lean Canvas, Revisit product/service, Business model, Team formation**. Refining Business Model –**Pivoting, Types of Business Model, Refining Business Models, Evaluate business model, Identify additional customer segments, Analyze Business Model of Competitors, Importance of Product Management.

MODULE II BUSINESS PLANNING & REVENUE 8

Business Planning – Introduction to Business Plan, Make a Sales Plan, Hiring Sales Team, Make a People Plan for Venture, Financial Planning and Forecasting Template, Revisit Business Model, Create a Procurement Plan, Negotiation. **Revenue** –Exploring ways to Increase Revenue, Understanding Primary Revenue Source, Customer Lifecycle for Growing Customers, Exploring Secondary Sources of Revenue.

MODULE III FUNDING GROWTH & BUILDING A-TEAM 7

Funding Growth – Funding Options for an Entrepreneur, Explore the Right Funding Options, Exploring crowd funding platforms, Create Your Funding Plan,

Pitch Practice. **Building A-Team** – Intro to Building an A-Team, Defining roles and responsibilities, Pitching to Attract Talent, Setting Your Team Up for Success, Defining Role of a New Hire

.

MODULE IV BRANDING AND CHANNEL STRATEGY 7

Branding and Channel Strategy– Intro to Branding, Draw your Venture's Golden Circle, Define Your Values, Positioning Statements, Selecting Brand Name, Social Media Handle, Logo and Mobile app names forYour Venture, Creating online public profiles, Bulls Eye Framework and other traditional channel types, Identify your Right Channel using Bulls Eye Framework.

MODULE V LEVERAGING TECHNOLOGIES AND AVAILABLE PLATFORMS & MEASURING PROGRESS 8

Leveraging Technologies and Available Platforms – Leaping Ahead with Technology, Digital Marketing for Your Startup, Plan a Social Media Campaign, Digital Collaboration, Store Your Documents Online, Other Platforms, Make Your Tech Plan and Platform Wish List. Measuring Progress – Metrics for Customer Retention and Satisfaction, Find your CAC, CLV, and ARPU, Key Financial Metrics, How to Communicate Your Metrics, Find New Revenue Streams based on Your Key Financial Metrics, Re-forecast your Financial Plan to Increase Margin.

MODULE VI LEGAL MATTERS & SEEKING SUPPORT & FINAL PROJECT 7

Legal Matters – Identify the Professional Help and Legal and Compliance Requirements for Your Venture, Conduct a Trademark Search for Your Company/Brand Name. **Seeking Support** – How Mentors Help to Create Successful Startups, Identify Mentors and Advisors, Scout for Board of Directors.**Final Project –** Capstone Project Presentation.

Total Periods- 45

TEXT BOOKS

1. Learn wise platform - Wadhwani Foundation, 2018.
2. All Lessons are delivered as Online videos accessible using Wadhwani Foundation's Learnwise Platform - https://lms.learnwise.wfglobal.org

OUTCOMES:

On completion of the course, students will be able to

- Achieve sustainable growth by pivoting, refining business models, expand customer segments, and business planning for developing early customer traction into a repeatable business.
- Develop strategies to grow revenues and markets.
- Develop an A-Team, brand strategy and create digital presence.
- Develop brand and channel strategy for customer outreach
- Leverage social media to reach new customers cost effectively.
- Explore licensing and franchising for business expansion.

GECX220	ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of Electric Vehicles.
- To familiarize the basic energy transfer processes that govern existing and proposed methods of power generation for Electric Vehicles.
- To familiarize with the traditional and non-traditional sources for Electric Vehicles in terms of energy content, accessibility, required processing steps and projected remaining reserves

MODULE I INTRODUCTION 8

A Brief History - Types of Electric Vehicle in Use Today : Battery electric vehicles - The IC engine/electric hybrid vehicle - Fuelled electric vehicles - Electric vehicles using supply lines - Solar powered vehicles - Electric vehicles which use flywheels or super capacitors - Ultra Capacitor – Ultra high Speed Flywheels.

MODULE II BATTERIES 7

Battery Parameters - Lead Acid Batteries - Nickel-based Batteries - Sodium-based Batteries - Lithium Batteries - Metal Air Batteries - Battery Charging - Choice of Battery - Use of Batteries in Hybrid Vehicles - Battery Modeling.

MODULE III FUEL CELLS 8

Hydrogen Fuel Cells - Fuel Cell Thermodynamics - Connecting Cells in Series - Water Management in the PEM Fuel Cell - Thermal Management of the PEM Fuel Cell - A Complete Fuel Cell System - Hydrogen Supply - Fuel Reforming - Hydrogen Storage.

MODULE IV ELECTRIC VEHICLE MODELLING AND DESIGN CONSIDERATIONS 7

Tractive Effort - Modeling Vehicle Acceleration - Modelling Electric Vehicle Range - Aerodynamic Considerations - Transmission Efficiency - Electric Vehicle Chassis and Body Design - General Issues in Design.

MODULE V DESIGN OF ANCILLARY SYSTEMS 7

Heating and Cooling Systems - Design of the Controls - Power Steering - Choice of Tyres - Wing Mirrors, Aerials and Luggage Racks - Electric Vehicle Recharging

and Refueling Systems.

MODULE VI ENVIRONMENTAL IMPACT AND ENERGY STORAGE 8

Vehicle Pollution - The Effects - A Quantitative Analysis - Vehicle Pollution in Context - Alternative and Sustainable Energy Used via the Grid Hybridization of Energy Storages - Energy Consumption in Braking - Brake System of EVs and HEVs - Antilock Brake System.

Total Hours – 45

REFERENCES:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained”,John Wiley & Sons Ltd, 2nd edition, 2015.
2. M. Ehsani, Y. Gao, Stefano Lango, K.M.Ebrahimi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 3rd Edition,2018.
3. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition, CRC Press, 2016.
4. Tom Denton, “Electric and Hybrid Vehicles” Routledge Publishers, 1st edition, March 2016.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identify and quantify the important energy transfer for Batteries and fuel cell schemes.
- Identify the opportunities and challenges of advances in Electric Vehicles.
- Choose a suitable drive scheme for developing an electric hybrid vehicle depending on Resources
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
- Choose proper energy storage systems for vehicles
- Identify the current industry activities by car makers, electricity utilities, parts, suppliers (motors and batteries), including joint ventures, product announcements and pilot projects.

GECX 221 ARTIFICIAL INTELLIGENCE AND EVOLUTIONARY COMPUTING USING MATLAB

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OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To provide adequate knowledge about fuzzy set theory.
- To provide comprehensive knowledge of fuzzy logic control and its application to real time systems.
- To expose the ideas of GA and EP in optimization and control.

MODULE I FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS 9

Objectives,history, biologicalinspiration, neuron model, McCulloch-Pitts neuron model, single-input neuron, multi-input neuron, network architectures, perceptron architecture, single-neuron perceptron, multi-neuron perceptron, perceptron learning rule, constructing learning rules, training multiple-neuron perceptron

MODULE II ASSOCIATIVE NETWORKS 9

Simple associative networks, auto-associative and hetero-associative nets, learning in neural nets, supervised and unsupervised learning, unsupervised Hebb rule, Kohonen rule, ADALINE and MADALINE network, back propagation neural networks,Hopfield networks, adaptive networks, applications using Neural Network toolbox in Matlab.

MODULE III FUZZY SET THEORY 6

Fuzzy versus crisp, crisp sets, fuzzy sets, operations and properties, membership function, crisp relations, fuzzyrelations.

MODULE IV FUZZY SYSTEMS 6

Crisp logic – fuzzy logic – fuzzy rule-based system- defuzzification methods – applications – Greg Viot’s fuzzy cruise controller - fuzzy logic control using FIS in Matlab

MODULE V FUNDAMENTALS OF GENETIC ALGORITHMS 7

Genetic algorithms, history, basic concepts, working principle, encoding, fitness function, reproduction

MODULE VI GENETIC MODELING AND APPLICATIONS 8

Genetic operators, cross over types, mutation operator, coding steps of GA, convergence characteristics, applications of AI techniques in various domains using GATOOL in matlab

Total Hours –45

REFERENCES:

1. Laurance Fausett, Englewood cliffs, N.J., 'Fundamentals of Neural Networks',Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill,1997.
3. David Goldberg, "Genetic Algorithms and Machine learning", PHI
4. Wassermann, P. D. "Neural Computing" Van Reinhold, 1988.
5. Zimmermann, H. J., 'Fuzzy Set Theory and Its Applications', 2nd Edition,Kluwer Academic Publishers.
6. Martin T. Hogan, Howard B.Demuth. M,'Neural network design'4th edition
7. Zureda, J.M.,'Introduction to Artificial Neural Systems', Jaico publishing house Bombay, 1994.
8. Bose N.K, Liang P. 'Neural Network Fundamentals with graphs, Algorithms and applications', TMH Pub. Co. Ltd, 2001.
9. S.Rajasekaran, G.A.Vijayalaksmi Pai , Neural Networks, Fuzzy logic and Genetic algorithms Synthesis and Applications , PHI private learning Ltd.,.New Delhi, 2011.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge andachieve skills on the following:

- Enumerate the theoretical basis of soft computing.
- Discuss the neural networks and supervised and unsupervised learning networks
- Design suitable neural networks, fuzzy systems, genetic representations with appropriate fitness functions for simple problems
- Apply the most appropriate soft computing algorithm for a given situation
- Know the key issues in using these techniques for search of difficult search-spaces
- Be aware of the different approaches and different applications in the field.