
# REGULATIONS 2017

# CURRICULUM AND SYLLABI

## B.TECH.

## COMPUTER SCIENCE AND ENGINEERING

## VISION AND MISSION OF THE INSTITUTION

### VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the socio-Economic progress of the Country.

### MISSION

- To blossom into an internationally renowned Institution
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through scientific enquiry, Applied research and Innovation

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## VISION AND MISSION

### VISION

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

### MISSION

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

## PROGRAMME EDUCATIONAL OBJECTIVES

- To introduce the fundamentals of science and engineering concepts essential for a computer engineer
- To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving
- To provide knowledge in computer science, modeling & design of computer based systems
- To impart knowledge to analyze, design, test and implement software required for various applications
- To hone personality skills, trigger social commitment and inculcate societal responsibilities.

## PROGRAMME OUTCOMES

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

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

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

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

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

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

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

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

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

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

PO11: Apply the hardware and software project management techniques to estimate the time and human resources required to complete computer engineering projects.
PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Programme Specific Outcomes**

PSO1: Understand, analyze and develop essential proficiency in the areas related to algorithms, system software, multimedia, web design, big data analytics, networking and apply the knowledge to solve practical problems.
PSO2: Apply standard practices and strategies in hardware and software project development using open-ended programming environments for successful career and entrepreneurship.

# REGULATIONS - 2017

# B.TECH. DEGREE PROGRAMMES

## 1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

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

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

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, 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 of B.S.Abdur Rahman Crescent Institute of Science and Technology who 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. Manufacturing Engineering
10. Mechanical Engineering
11. Polymer Engineering
12. Biotechnology
13. Cancer Biotechnology
14. Food Biotechnology

## 4.0 STRUCTURE OF THE PROGRAMME

**4.1** Every Programme will have 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.

**4.3** Each semester curriculum shall normally have a blend of lecture courses, laboratory courses and laboratory integrated theory courses of total not exceeding 26 credits.

**4.4** For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the relevant branch of study. The minimum credits to be earned will be between 174 and 180, depending on the program.

**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 will 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 will 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) will be 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 will 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.

## 7.0 COURSE 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 will be constituted branch-wise and semester-wise

**8.1** The composition of class committees for first and second semester will be 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 3$^{rd}$ to 8$^{th}$ semester will be 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 four times during the semester. The first meeting will 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 will be decided for the first and second assessment. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

**8.4** During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process.

**8.5** The fourth 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 ENROLMENT

**9.1** Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the ongoing semester. Every student shall submit a completed registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of the Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current

semester.

**9.2** From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

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

9.4 A student should have registered for all preceding semesters before registering for a particular 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 assessment for 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 assessment of 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 will 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 ENROLMENT & 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:

| Assessment No. | 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 Exam | 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 will 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.

**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 will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation. The weightage for 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(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50%. Of the remaining 50%, 20% will be for the project report and 30% for the Viva Voce examination.

**13.8** Assessment of seminars and comprehension will 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 will 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 has missed, for genuine reasons, a maximum of one of the two continuous assessments of a course may be permitted to write a substitute examination paying the prescribed substitute examination fees. 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 Dean of School for that purpose. However there is no Substitute Examination for Semester End examination.

**14.2** A student who misses any continuous assessment test in a course 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 missed assessment test. However the Substitute Examination will be conducted after the last working

day of the semester and before 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 Institution 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 will 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 re-do 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 will 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 will 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 will not be 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 will 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 will 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 Schools 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 will contain the following details. The list of courses enrolled during the semester including redo courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the 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 shall be calculated in a similar manner, considering all the courses enrolled from first semester.

**“I” and "W"** grades will be excluded for calculating GPA .

**"U", “I”, "AB"** and **"W"** grades will be 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 will 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 will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will 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/ self study courses not exceeding a total of six credits 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. In case of credits earned through online mode ratified by the respective Board of Studies, the credits may be transferred following the due approval procedures. The students shall undergo self study courses on their own with the mentoring of a member of the faculty. The online/ self study courses can be considered in lieu of elective courses.

## 19.0 SUPPLEMENTARY EXAMINATION

Final Year students can apply for supplementary examination for a maximum of two courses thus providing an opportunity to complete their degree programme. Like wise students with less credits can also apply for supplementary examination for a maximum of two 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.

## 20.0 PERSONALITY AND CHARACTER DEVELOPMENT

**20.1** All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.
- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.

- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

**21.0 DISCIPLINE**

**21.1** Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to affect the prestige of the Institution.

**21.2** Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean will be referred to a Discipline and Welfare Committee nominated by the Vice-Chancellor, 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. degree provided 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

iii) no disciplinary action pending against him/her.

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

**23.0 POWER TO MODIFY**

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

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

**B.TECH. COMPUTER SCIENCE ENGINEERING**

**CURRICULUM & SYLLABUS, 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 1181 | 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 Programming I | 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 | GEC 1211 | Basic Engineering Mechanics | 3 | 1 | 0 | 4 |
| 5. | BS | GEC 1212 | Environmental Studies | 2 | 0 | 0 | 2 |
| 6. | ESF | GEC 1213 | Computer Programming II | 1 | 0 | 2 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7. | EC | CSC 1211 | Digital System | 3 | 0 | 2 | 4 | |
| 8. | EC | CSC 1212 | Python Programming | 2 | 0 | 0 | 2 | **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 | CSC 2101 | Data Structures | 3 | 1 | 0 | 4 | |
| 5. | EC | CSC 2102 | Computer Networks | 3 | 0 | 2 | 4 | |
| 6. | EC | CSC 2103 | Software Engineering | 3 | 0 | 0 | 3 | |
| 7. | EC | CSC 2104 | Object Oriented Programming | 3 | 0 | 0 | 3 | |
| 8. | EC | CSC 2105 | Data structures Lab | 0 | 0 | 2 | 1 | |
| 9. | EC | CSC 2106 | Object Oriented Programming Lab | 0 | 0 | 2 | 1 | **23** |

**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 | ENC 2282 | Written Communication | 0 | 0 | 2 | 1 |
| 4. | EC | CSC 2211 | Computer architecture and microprocessor | 3 | 0 | 0 | 3 |
| 5. | EC | CSC 2212 | Analysis of Algorithms | 3 | 1 | 0 | 4 |
| 6. | EC | CSC 2213 | Network Security and Cryptography | 3 | 0 | 0 | 3 |
| 7. | EC | CSC 2214 | Database Management Systems | 2 | 0 | 0 | 2 |
| 8. | EC | CSC 2215 | DBMS Lab | 0 | 0 | 2 | 1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 9. | EC | CSC 2216 | Security Lab | 0 | 0 | 2 | 1 | |
| 10. | PE | | Programme Elective ##1 | | | | 3* | **24** |

## SEMESTER V

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C | |
|---|---|---|---|---|---|---|---|---|
| 1. | MS | MSC 3181<br>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 & soft skill – I Career Choice | 0 | 0 | 2 | 1 | |
| 4. | EC | CSC 3101 | Operating Systems | 3 | 0 | 0 | 3 | |
| 5. | EC | CSC 3102 | Web Development using JAVA | 3 | 0 | 0 | 3 | |
| 6. | EC | CSC 3103 | Artificial Intelligence and Machine Learning | 3 | 0 | 0 | 3 | |
| 7. | EC | CSC 3104 | Web Development Lab | 0 | 0 | 2 | 1 | |
| 8. | PE | | Programme Elective ##2 | | | | 6** | **23** |

## SEMESTER VI

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | EF | MSC 3181<br>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 Confidence Building | 0 | 0 | 2 | 1 |
| 4. | EC | CSC 3211 | Big Data Analytics | 3 | 0 | 0 | 3 |
| 5. | EC | CSC 3212 | Distributed Computing | 3 | 0 | 0 | 3 |
| 6. | EC | CSC 3213 | Graph Theory and Application | 3 | 1 | 0 | 4 |
| 7. | EC | CSC 3214 | Big Data Analytics Tools Lab | 0 | 0 | 2 | 1 |
| 8. | EC | CSC 3215 | Mobile Application Development Lab | 0 | 0 | 2 | 1 |

| | | | | | |
|---|---|---|---|---|---|
| 9. | PE | - | Programme Elective ##3 | 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 | CSC 4101 | Software project management | 3 | 0 | 0 | 3 | |
| 3. | EC | CSC 4102 | Compiler Design | 3 | 0 | 0 | 3 | |
| 4. | EC | CSC 4103 | Cloud Computing | 3 | 0 | 2 | 4 | |
| 5. | EC | CSC 4104 | Compiler Lab | 0 | 0 | 2 | 1 | |
| 6. | EC | CSC 4105 | Internship | 0 | 0 | 0 | 1* | |
| 7. | PE | - | Programme Elective ##4 | | | | 9** | **24** |

**SEMESTER VIII**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C | |
|---|---|---|---|---|---|---|---|---|
| 1. | EC | CSC 4211 | 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.

## ELECTIVE LIST

## SEMESTER IV

### Programme Elective ##1 (3 Credits*)

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X201 | Multimedia and Animation | 3 | 0 | 0 | 3 |
| 2. | PE | CSC X202 | VFX | 2 | 0 | 0 | 2 |
| 3. | PE | CSC X203 | Digital Transmission | 3 | 0 | 0 | 3 |
| 4. | PE | CSC X204 | Information Technology in Organization | 3 | 0 | 0 | 3 |
| 5. | PE | CSC X205 | Innovation and New product development | 3 | 0 | 0 | 3 |
| 6. | PE | CSC X206 | Fundamentals of Computer Forensics | 2 | 0 | 0 | 2 |
| 7. | PE | CSC X207 | Open Source Technologies | 2 | 0 | 2 | 3 |
| 8. | PE | CSC X208 | User Interface Design | 2 | 0 | 0 | 2 |
| 9. | PE | CSC X209 | Stress Management | 1 | 0 | 0 | 1 |
| 10. | PE | CSC X210 | Information Ethics | 1 | 0 | 0 | 1 |

## SEMESTER V

### Programme Elective ##2 (3+3 Credits*)

#### Elective 1 (3 Credits*)

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X101 | 2D Character Animation | 2 | 0 | 0 | 2 |
| 2. | PE | CSC X102 | Image processing | 2 | 0 | 2 | 3 |
| 3. | PE | CSC X103 | Multimedia Application Development | 2 | 0 | 0 | 2 |
| 4. | PE | CSC X104 | 3D Animation | 2 | 0 | 2 | 3 |
| 5. | PE | CSC X105 | Advanced Computer Graphics | 2 | 0 | 2 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | PE | CSC X106 | Multimedia Design program | 2 | 0 | 2 | 3 |
| 7. | PE | CSC X107 | Network Modeling | 3 | 0 | 0 | 3 |
| 8. | PE | CSC X108 | Cellular and Wireless Networks | 3 | 0 | 0 | 3 |
| 9. | PE | CSC X109 | Network Management | 2 | 0 | 0 | 2 |
| 10. | PE | CSC X110 | Network Simulators | 1 | 0 | 0 | 1 |
| 11. | PE | CSC X111 | Agile practices | 1 | 0 | 0 | 1 |
| 12. | PE | CSC X112 | Software testing | 2 | 0 | 0 | 2 |
| 13. | PE | CSC X113 | Software Requirements and Modeling | 2 | 0 | 0 | 2 |
| 14. | PE | CSC X114 | Theory of Computation | 3 | 0 | 0 | 3 |
| 15. | PE | CSC X115 | Internet of Things | 2 | 0 | 0 | 2 |
| 16. | PE | CSC X116 | Cognitive Science | 2 | 0 | 0 | 2 |
| 17. | PE | CSC X117 | Virtualization Techniques | 3 | 0 | 0 | 3 |

**Elective 2 (3 Credits*)**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X122 | Foundation on Robotics | 2 | 0 | 0 | 2 |
| 2. | PE | CSC X123 | Sound Editing and processing | 2 | 0 | 2 | 3 |
| 3. | PE | CSC X124 | Computer Vision | 3 | 0 | 0 | 3 |
| 4. | PE | CSC X125 | Mobile Multimedia Systems | 2 | 0 | 0 | 2 |
| 5. | PE | CSC X126 | Scripting Languages | 2 | 0 | 2 | 3 |
| 6. | PE | CSC X127 | Online video production | 1 | 0 | 0 | 1 |
| 7. | PE | CSC X128 | Multimedia security | 2 | 0 | 0 | 2 |
| 8. | PE | CSC X129 | Multimedia Communication and Networking | 3 | 0 | 0 | 3 |
| 9. | PE | CSC X130 | Gaming Technology | 3 | 0 | 2 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10. | PE | CSC X131 | Routing Protocols | 3 | 0 | 0 | 3 |
| 11. | PE | CSC X132 | Queuing Theory | 3 | 0 | 0 | 3 |
| 12. | PE | CSC X133 | Network Trouble shooting tools | 1 | 0 | 0 | 1 |
| 13. | PE | CSC X134 | Design of Computer Network services | 3 | 0 | 0 | 3 |
| 14. | PE | CSC X135 | Software architecture for the internet of things | 1 | 0 | 0 | 1 |
| 15. | PE | CSC X136 | Software metrics | 2 | 0 | 0 | 2 |
| 16. | PE | CSC X137 | Multicore Architecture | 2 | 1 | 0 | 3 |
| 17. | PE | CSC X138 | Statistics and analytics using R programming | 2 | 0 | 2 | 3 |
| 18. | PE | CSC X139 | C# & .NET | 2 | 0 | 0 | 2 |

## SEMESTER VI

### Programme Elective ##3(3+3)

### Elective 1 (3 Credits*)

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X214 | Information Retrieval | 2 | 0 | 2 | 3 |
| 2. | PE | CSC X215 | Software Risk Management | 1 | 0 | 0 | 1 |
| 3. | PE | CSC X216 | Social Media Security | 2 | 0 | 0 | 2 |
| 4. | PE | CSC X217 | Web Security | 2 | 0 | 0 | 2 |
| 5. | PE | CSC X218 | Software design and architecture | 1 | 0 | 0 | 1 |
| 6. | PE | CSC X219 | Software Configuration Management | 2 | 0 | 0 | 2 |
| 7. | PE | CSC X220 | Human Computer Interaction | 2 | 0 | 0 | 2 |
| 8. | PE | CSC X221 | Green Computing | 3 | 0 | 0 | 3 |
| 9. | PE | CSC X222 | XML and Web services | 2 | 0 | 0 | 2 |
| 10. | PE | CSC X223 | Business Process Management | 3 | 0 | 0 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 11. | PE | CSC X224 | Advanced Machine Learning | 3 | 0 | 0 | 3 |

**Elective 2 (3 Credits*)**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X228 | Information Visualization | 2 | 1 | 0 | 3 |
| 2. | PE | CSC X229 | Cyber Forensics | 3 | 0 | 0 | 3 |
| 3. | PE | CSC X230 | Smart Devices Security | 1 | 0 | 0 | 1 |
| 4. | PE | CSC X231 | Biometric Security | 3 | 0 | 0 | 3 |
| 5. | PE | CSC X232 | Database Security | 3 | 0 | 0 | 3 |
| 6. | PE | CSC X233 | Software Quality Assurance | 3 | 0 | 0 | 3 |
| 7. | PE | CSC X234 | Customer Relationship Management | 1 | 0 | 0 | 1 |
| 8. | PE | CSC X235 | Service Oriented Architecture | 2 | 0 | 0 | 2 |
| 9. | PE | CSC X236 | Genetic Algorithm | 3 | 0 | 0 | 3 |
| 10. | PE | CSC X237 | Enterprise Resource Planning | 2 | 1 | 0 | 3 |
| 11. | PE | CSC X238 | API Design | 2 | 0 | 0 | 2 |

## SEMESTER VII

**Programme Elective ##4 (3+3+3)**

**Elective 1 (3 Credits*)**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X143 | Deep Learning | 2 | 0 | 2 | 3 |
| 2. | PE | CSC X144 | Intrusion Detection and Prevention | 3 | 0 | 0 | 3 |
| 3. | PE | CSC X145 | Security Law and Compliance | 2 | 0 | 0 | 2 |
| 4. | PE | CSC X146 | Software Design patterns | 1 | 0 | 0 | 1 |
| 5. | PE | CSC X147 | Writing skills for engineering leaders | 1 | 0 | 0 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | PE | CSC X148 | Software Reliability | 2 | 0 | 0 | 2 |
| 7. | PE | CSC X149 | AAIP – Animation with Portfolio Development | 2 | 0 | 2 | 3 |
| 8. | PE | CSC X150 | Advanced SAS: Macros & SQL | 2 | 0 | 0 | 2 |
| 9. | PE | CSC X151 | Advanced Programming in Data Science with Python | 3 | 0 | 0 | 3 |

**Elective 2 (3 Credits*)**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X155 | Security Issues in Cloud Computing | 3 | 0 | 0 | 3 |
| 2. | PE | CSC X156 | Security Evaluation and Assessment Methodology | 3 | 0 | 0 | 3 |
| 3. | PE | CSC X157 | Software process and product quality | 1 | 0 | 0 | 1 |
| 4. | PE | CSC X158 | System Integration | 2 | 0 | 0 | 2 |
| 5. | PE | CSC X159 | IBM Websphere | 2 | 0 | 2 | 3 |
| 6. | PE | CSC X160 | AVIP - Broadcast | 1 | 0 | 0 | 1 |
| 7. | PE | CSC X161 | Full Stack mobile application development I (Front end) | 2 | 0 | 2 | 3 |
| 8. | PE | CSC X162 | Advanced Game Design | 2 | 0 | 0 | 2 |

**Elective 3 (3 Credits)**

| Sl. No. | Course Group | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|---|
| 1. | PE | CSC X166 | Web Application Security | 2 | 0 | 0 | 2 |
| 2. | PE | CSC X167 | Cyber Laws and Ethics | 2 | 0 | 0 | 2 |
| 3. | PE | CSC X168 | Secure Interconnecting systems | 3 | 0 | 0 | 3 |
| 4. | PE | CSC X169 | Software Maintenance | 2 | 0 | 0 | 2 |
| 5. | PE | CSC X170 | Personal Software Process | 1 | 0 | 0 | 1 |
| 6. | PE | CSC X171 | Web analytics and Social media mining | 3 | 0 | 0 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7. | PE | CSC X172 | Ruby | 1 | 0 | 0 | 1 |
| 8. | PE | CSC X173 | Full Stack mobile application development II (Back end) | 2 | 0 | 2 | 3 |
| 9. | PE | CSC X174 | 5G Wireless communication Techniques | 3 | 0 | 0 | 3 |

*** - Student has to take either 3 Credit or 2+1 Credits**

**** - Sum of the credits of the electives**

## 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 | Course Title | 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 | Mat Lab Simulation | EEE |
| 8. | GECX208 | Embedded Systemsand 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 |
| 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 |

**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 1181 | PHYSICS | 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, CO2 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 RENEWABLE ENERGY SOURCES 7**

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

**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.

**L – 45; P – 30; TOTAL HOURS – 75**

**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:**

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

**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 method: – lime soda and 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, disinfection }– desalination: electrodialysis, reverse osmosis.

**MODULE II NANOCHEMISTRY 6**

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

**MODULE III ENERGY SOURCES 8**

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

**MODULE IV PHOTOCHEMISTRY 7**

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

**MODULE V ANALYTICAL TECHNIQUES 7**

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

**MODULE VI ELECTROCHEMISTRY 8**

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

**PRACTICALS**

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of $Fe^{2+}$ present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of $Cu^{2+}$ present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

**L – 45; P – 30; TOTAL HOURS – 75**

**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.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

| 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 | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 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 | 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 logical and 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.

**Biodiversit**y - 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 | 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.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

**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.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

| CSC1211 | DIGITAL SYSTEM | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- Expose Boolean algebra, Boolean functions and realization of functions with basic gates.
- To design combinational and sequential circuits.
- To implement the K-map method for logical operation.
- To use the concepts of state and state transition for analysis and design of sequential circuits.
- Use the functionality of flip-flops for analysis and design of sequential circuits
- To learn Hardware Design language programming for Digital Systems.

**MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 07**

Review of Binary Number Systems - Binary Arithmetic - Binary Codes - Boolean Algebra and Theorems -.Boolean functions- Canonical and Standard forms - Logic operations-Digital Logic Gates.

**MODULE II GATE-LEVEL MINIMIZATION 08**

The K-Map method-Two variable-Three variable-Four Variable -Product of sums simplification - Don't care conditions- NAND and NOR implementation - - Other two level implementation – Exclusive OR function - Hardware Description Language .

**MODULE III COMBINATIONAL LOGIC 08**

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

**MODULE IV SYNCHRONOUS SEQUENTIAL LOGIC 08**

Sequential Circuits - Latches and Flip Flops - Analysis of clocked sequential

circuits- - Synthesizable HDL models of Sequential circuits – State Table ,State Reduction Diagram and State Assignment – Design Procedure.

**MODULE V REGISTERS, COUNTERS, MEMORIES 06**

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

**MODULE VI DESIGN AT THE REGISTER TRANSFER LEVEL 08**

Introduction-Register Transfer Level Notation-Register transfer level in HDL-ASMs-Sequential Binary multiplier-Control Logic-HDL description of Binary Multiplier-Design with Multiplexers.

**L – 45; P – 30; TOTAL HOURS – 75**

**REFERENCES:**

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", Pearson Education, Fifth Edition, ISBN-13: 978-0-13-277420-8, 2012.
2. Charles H.Roth, Jr., Kinney," Fundamentals of Logic Design", Brooks Publications, Seventh Edition,. ISBN-13 :978 -1-133-62848-4,2013
3. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, Third Edition, ISBN 0072525037, 2003.

**OUTCOMES :**

Students who complete this course will be able to

- Define different number systems, binary addition and subtraction, 2's complement representation and its operations
- Demonstrate the use of Karnaugh map and perform an algorithmic reduction of logic functions.
- Define the following combinational circuits: buses, encoders/decoders, (de)multiplexers, exclusive-ORs, comparators, arithmetic-logic units; and to build simple applications
- Evaluate the concepts of state and state transition for analysis and design

of sequential circuits.

- Design and develop simple projects Using flip flops after state machine analysis.
- Expose the basics of Hardware Design language to design digital circuits.

| CSC1212 | PYTHON PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES:**

- To Learn simple data types, and expressions.
- To learn the control structures of Python programming.
- To know the scope of the variables used in functions.
- To Write large programs in Python, with modules.
- To learn objects, classes, and other object-oriented features
- To study the different types of inheritance concepts.

**MODULE I INTRODUCTION TO PYTHON 10**

Basic Elements of Python – Object, Expression and Numeric Types – Variables and Assignments – Data types - Input statements – Input Statements – Branching Programs – Looping Programs.

**MODULE II FUNCTIONS AND STRUCTURES 10**

Functions and Scoping – Function Definitions – Keyword Arguments and Default values – Scoping – Specifications – Recursion –Global Variables – Modules – Tuples – Lists – Dictionaries.

**MODULE III CLASSES AND OBJECTS 10**

Abstract Data Types – Classes – Inheritance – Multiple level of Inheritance – Substitution Principles – Encapsulation and Information Hiding.

**TOTAL HOURS – 30**

**REFERENCES:**

1. John V. Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, MIT Press, ISBN: 978-0262529624, 2016.
2. Bill Lubanovic, “Introducing Python: Modern Computing in Simple Package”, O'Reilly Media, 1st Edition, ISBN: 9781449359362, 2014.
3. Pratik Desai ,“Python Programming for Arduino”,1st edition, Packt publishing,

ISBN:9781783285938, 2015.

**OUTCOMES:**

Students who complete this course will be able to

- Identify the elements of python and the different types of data.
- write loops and decision statements in Python.
- explore Python code structure, including the use of functions.
- Implement lists, tuples, and dictionaries in Python programs
- design object oriented programs with Python classes.
- Use class inheritance in Python for reusability.

**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 Hours –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.

**CSC 2101** **DATA STRUCTURES** **L T P C**
**3 1 0 4**

**OBJECTIVES :**

- To assess how the choice of data structures impacts the performance of programs
- To design and implementation of various basic and advanced data structures
- To expose the different types of searching and sorting algorithms.
- To employ the different data structures to find the solutions for specific problems.
- To improve the logical ability
- To develop application using data structures.

**MODULE I OVERVIEW , ARRAYS, RECORDS AND POINTERS 08**

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

**MODULE II LINKED LIST 08**

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

**MODULE III STACKS, QUEUES AND RECURSION 07**

Stacks – Array Representation of Stacks-Linked Representation of Stacks – Arithmetic Expressions – Quick sort , an application of stacks – Recursion – Towers of Hanoi – Implementation of Recursive procedures by Stacks – Queues – Linked representation of Queues – Dequeues – Priority Queues

**MODULE IV TREES 08**

Binary Trees – Representing Binary Trees in Memory – Traversing Binary Trees – Traversal algorithm using Stacks – Header nodes ; Threads – Binary Search Trees searching and inserting in Binary Search Trees –Deleting in a Binary Search Trees - AVL Search Trees – Insertion in an AVL Search Trees – Deletion in an AVL Search Trees – m-way search trees – B trees – Heap; Heap sort – Path Length; Huffman's Algorithms – General Trees

**MODULE V GRAPHS AND THEIR APPLICATIONS 07**

Graph Theory Terminology – Sequential Representation of Graphs – Warshall's Algorithm –Linked Representation of a Graph – Operations on a Graph – Traversing a Graph – Posets ; Topological Sorting

**MODULE VI SORTING AND SEARCHING 07**

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

**L-45 ;T-15;TOTAL HOURS-60**

**REFERENCES :**

1. Seymour Lipschutz, "Data Structures", McGraw Hill Education, Revised First edition, ISBN-10: 1259029964, ISBN-13: 978-1259029967, 2014
2. Narasimha Karumanchi ,"Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" ,CareerMonk Publications, Fifth Edition, ISBN-10: 819324527X, ISBN-13: 978-8193245279, 2016.
3. Reema Thareja, "Data Structures Using C", Oxford Publisher, Second Edition, ISBN-10: 0198099304, ISBN-13: 978-0198099307 , 2014
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education; Second edition, ISBN-10: 9332535841,ISBN-13: 978-9332535848, 2014.

**OUTCOMES:**

Students who complete this course will be able to

- Examine a given problem and recommend suitable data structure.
- Implement operations on arrays, linked lists, stacks and queues.
- Design, implement, test, and debug programs using a variety of data structures including binary and general tree structures, search trees, heaps, graphs, and B-trees.
- Compare between different data structures and pick an appropriate data structure for a design situation.
- Employ Algorithm for solving problems like sorting, searching, insertion and deletion of data.
- Apply concepts learned in various domains like DBMS, compiler construction etc.

**CSC 2102** **COMPUTER NETWORKS** **L T P C**
**3 0 2 4**

**OBJECTIVES :**

- To study the networked system organization and architecture, current practices and recent trends
- To lay the foundation on emerging network and data communication technologies and their potential impact
- To provide knowledge on socket programming using TCP and UDP.
- To explore the modern network architectures from a design and performance perspective.
- To understand and design the mobile and wireless network protocols.
- To identify various network parameters to increase QoS for multimedia networks.

**MODULE I INTRODUCTION TO COMPUTER NETWORKS** **07**

Need for Networking - Service Description -Connectionless and Connection-oriented Services - Circuit and Packet Switching - Physical Media - Wireless Links and Characteristics - Queuing Delay and Packet Loss - Internet Protocol stack - OSI Reference Model - Service Models.

**MODULE II APPLICATION LAYER** **07**

Principles of Network Applications - The Web and HTTP - FTP - Electronic Mail - SMTP - DNS - Peer-to-Peer Applications.

**MODULE III TRANSPORT LAYER** **08**

Transport Layer Services - Multiplexing and Demultiplexing - UDP – Principles of Reliable Data Transfer - Connection-oriented Transport: TCP – Principles of Congestion Control - TCP congestion control mechanism – Socket Programming with TCP and UDP - Implementation of transport layer protocols using open source network simulators.

**MODULE IV NETWORK LAYER AND LINK LAYER** **09**

Forwarding and Routing - Network Service Models - Virtual Circuit and Datagram Networks - Router - Internet Protocol (IP) - Routing algorithms - Implementation of network layer protocols using open source network simulators - Layer Services - Error Detection and Correction Techniques - Multiple Access Protocols - Switched Local Area

Networks - Link Virtualization - Data Center Networking.

**MODULE V WIRELESS AND MOBILE NETWORKS 07**

Wireless Links and Network Characteristics - WiFi: 802.11 Wireless LAN - Cellular Internet Access - Mobility Management: Principles - Mobile IP - Wireless and Mobility: Impact on Higher-Layer Protocols - Implementation of mobile routing protocols using open source network simulators.

**MODULE VI MULTIMEDIA NETWORKING 07**

Multimedia Networking Applications - Voice-over-IP - Protocols for Real-Time Interactive Applications - Network Support for Multimedia.

**L – 45;P-30;TOTAL HOURS-75**

**REFERENCES :**

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, ISBN:9780133594140,2017.
2. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” Elsevier, 5th Edition, ISBN: 978-0123850591, 2012.
3. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols, and Architecture” 6th Edition, PHI, ISBN: 9780136085300, 2014.
4. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 5th Edition , illustrated, ISBN : 9780073376226, 2012.

**OUTCOMES:**

Students who complete this course will be able to

- Compare and contrast the OSI reference model and TCP/IP model.
- Examine the various application layer protocols and propose the solutions based on the need.
- Review the protocols, network interfaces, and performance issues in local area networks and wide area networks.
- Identify different congestion control techniques and critique upon them.
- Design and implement the routing and transport protocols for Wireless and Mobile networks.
- Analyze and interpret the effect of QoS Parameters in the multimedia networks.

**CSC 2103 SOFTWARE ENGINEERING L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To introduce the process involved in developing software.
- To guide the importance of requirements gathering.
- To represent the requirements collected using the various design models
- To provide knowledge in developing a software in a systematic method with quality.
- To explore the various testing methodologies.
- To understand how to improve performance of a software product.

**MODULE I SOFTWARE PROCESS 07**

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

**MODULE II REQUIREMENTS GATHERING 08**

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

**MODULE III DESIGN 09**

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

**MODULE IV QUALITY MANAGEMENT 07**

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

**MODULE V SOFTWARE TESTING 07**

Software Testing – Strategic Approach – Issues – Test Strategies – Validation Testing – System Testing – Debugging – Testing Fundamentals: Path Testing, White Box and Black Box, Control Structure – Testing Applications.

**MODULE VI MAINTENANCE 07**

Software Maintenance – Supportability – Reengineering – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Risk Management.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Roger S. Pressman, “Software Engineering – A Practitioners Approach”, Mc Graw Hill, Eighth Edition, ISBN -13: 9789339212087, 2014.
2. Ian Sommerville, “Software Engineering”, Addison-Wesley, 9th Edition, ISBN-13: 978-0137035151, 2010.
3. Jibitesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, ISBN 978-81-317-5869-4, 2012.

**OUTCOMES :**

Students who complete this course will be able to

- Choose the appropriate process model for the software application to be developed.
- Collect requirements based on the type of the application and its need.
- Design frameworks for the application to be developed.
- Ensure that the software satisfies the quality standards.
- Apply the appropriate testing strategies to the developed products.
- Modify and improve the deployed product based on user needs and performance results.

**CSC 2104 OBJECT ORIENTED PROGRAMMING L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To learn the concepts of object-oriented programming.
- To acquire knowledge and skills in OO design and program development.
- To explain the concepts of inheritance and polymorphism.
- To learn the syntax, features of, and how to utilize the Standard Template Library
- To study the concepts of Packages, Interfaces, Threading and Swing
- To expose the students to apply certain concepts in Network Programming.

**MODULE I INTRODUCTION 07**

Object oriented programming concepts –abstraction and encapsulation – inheritance – abstract classes – polymorphism- benefits of OOP– Introduction to C++ – Structure of C++ – access specifiers – function and data members –tokens, expressions and control Structures- data types-storage classes.

**MODULE II INHERITANCE 08**

Introduction – defining derived classes – single inheritance –multilevel inheritance-multiple inheritance-hierarchical inheritance hybrid inheritance – virtual base classes – abstract classes – constructors in derived classes.

**MODULE III POLYMORPHISM AND I/O OPERATIONS 08**

Pointers-this pointer-virtual functions –pure virtual function – virtual constructors and destructors– C++ stream classes – Unformatted I/O operations – formatted I/O operations – file stream operations-opening and closing a file –file modes – abstract class – error handling during file operations

**MODULE IV TEMPLATES AND EXCEPTION HANDLING 08**

Class templates – function templates – overloading of template functions – non-type template arguments – basics of exception handling – mechanism – throwing and catching mechanism – rethrowing an exception – exceptions in constructors and destructors - standard template library -components of STL–containers – algorithms – iterators - application of container classes.

**MODULE V INTRODUCTION TO JAVA 07**

Java: an Introduction, Life cycle of a Java program, Java virtual machine, Programming in

Java - Declaring Variables - Packages and Interfaces - Exception Handling. Java I/O streaming - Filter and pipe streams - Byte Code interpretation - Threading -Swing.

**MODULE VI NETWORK PROGRAMMING IN JAVA 07**

Sockets - Secure sockets - Custom sockets - UDP datagrams – Multicast sockets -URL classes - Reading Data from the server - Writing data - Configuring the connection- Reading the header- Java Messaging services.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. E.Balagurusamy,”Object Oriented Programming with C++”,6th Edition, Tata McGraw Hill Education,ISBN:9781259029936, 2013.
2. Matt Weisfeld," Object-Oriented Thought Process", 4th Edition, Pearson Education, ISBN: 9780321861276, 2013.
3. Hortsmann & Cornell, "Core Java Advance Features VOL II", 9th Edition, Pearson Education,ISBN: 9780137081608, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Experience in basic concepts of object oriented programming.
- Know practical knowledge in OO design concepts.
- Develop the template and exception handling programs,
- Write simple example programs using concepts of the standard template library.
- Demonstrate the OOP concepts applied in networking and web development.
- To implement OOP in various applications.

| CSC 2105 | DATA STRUCTURES LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES :**

- To make familiar with the data structure concepts.
- To design real time problems and find the way to implement the solution.
- To implement the Stack and Queue ADT.
- To traverse the tree and graph data structures.
- To implement searching and sorting techniques.
- To demonstrate the shortest path algorithm.

**SOFTWARE REQUIRED : C/C++/JAVA**

Design problems and implement solutions for the following concepts:

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

**P-15; TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Identify the data structure to provide a solution for the given problem.
- use object oriented concepts to solve the complex problems.
- apply Stack and Queue ADT.
- develop and implement the algorithm for the application.
- analyze the problem and identify the appropriate solution for it.
- implement linear and non-linear data structure concepts through programming.

**CSC 2106 OBJECT ORIENTED PROGRAMMING LAB**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**OBJECTIVES :**

- To make familiar with the object oriented concepts.
- To design real time problems and find the way to implement the solution.
- To implement and understand the object oriented concepts and application developments using C++.
- To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
- To implement File handling and Exception handling.
- To introduce object oriented concepts in C++ and Java.

**SOFTWARE REQUIRED : C++/JAVA**

Design problems and implement solutions for the following concepts:

1. Classes and Objects
2. Friend function and Inline function
3. Constructor and Destructor
4. Function Overloading and Operator Overloading
5. Inheritance
6. Virtual Function and Dynamic binding
7. File handling and Exception handling
8. Simple Java programs
9. Inheritance using java programs
10. Event handling using java programs
11. Networking using java programs

**P-15;TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Explain what constitutes an object-oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
- Use object oriented concepts to solve the complex problems.
- Identify the exception for the specific problem.
- Apply an object-oriented approach to developing applications of varying complexities.

- Analysis the application problem and identify the efficient solution for it.
- Implement networking concepts through programming.

**SEMESTER IV**

| ENC 2282 | 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 academic and 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.

**CSC 2211 COMPUTER ARCHITECTURE AND MICRO PROCESSOR**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To conceptualize the basics of organizational and architectural issues of a digital computer
- To develop an in-depth understanding of the operation of Central processing unit and ILP.
- Impart the knowledge about Control unit and the ideas about parallel organization.
- Provide the essentials of the processors and Develop assembly level programs using 8085.
- To understand fundamental architecture of 16 bit and 32 bit microprocessors.
- To offer a necessary ideas on microcontroller.

**MODULE I BASIC STRUCTURE OF COMPUTERS** **07**

Basics – Computer evolution and performance – Computer functions and interconnections –Cache memory – internal memory– external memory – I/O.

**MODULE II CENTRAL PROCESSING UNIT** **08**

Computer arithmetic – Instruction sets: characteristics and functions – addressing modes and formats – processor structure and functions – Reduced instruction set computers – Instruction level parallelism and superscalar processors.

**MODULE III CONTROL UNIT & PARALLEL ORGANIZATION**. **07**

Control unit operations – Micro programmed control – Parallel processing – Multi core computers.

**MODULE IV 8085 ARCHITECTURE** **08**

Microprocessor based systems hardware and interfacing – Programming 8085 – Interfacing peripherals and applications.

**MODULE V 8086 ARCHITECTURE** **07**

Basics of 8086 – Instruction set of 8086 – assembler directives –Interrupt systems –

classification – interrupts of 8086 – PIC (8259).

**MODULE VI MICROCONTROLLER 08**

Microprocessors and Microcontrollers - The 8051 micro controller- Moving Data – Logical operations – arithmetic operations – jump and call opcodes - applications.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**


1. William Stallings, "Computer Organization and Architecture - Designing for Performance", 10th Edition, Pearson Education, ISBN-13: 978013410613, 2015.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer organization", 5th Edition, McGraw Hill, ISBN 13:9781259005275, 2002.
3. John Kennessy and David Patterson, “Computer Architecture”, 5th edition, ISBN: 9780123838728, 2011.
4. Ramesh Goankar, “Microprocessor architecture, programming and applications with 8085”, 6th edition, Penram International Publishing, ISBN: 978-8187972884, 2013.
5. Mathur Sunil, “Microprocessor 8086: Architecture, Programming and Interfacing”, PHI, ISBN: 9788120340879, 2012.
6. Kenneth J Ayala,” The 8051 micro controller”, 3rd edition, Cengage Learning, ISBN: 9781401861582, 2010.


**OUTCOMES :**

Students who complete this course will be able to

- Clarify the essentials of the working of the computing units and trace the operation.
- Demonstrate the working of central processing unit.
- Illustrate the computer architectures and design issues and tradeoffs.
- Bring out the design of microprocessors / microcontrollers-based systems.
- Write an assembly language code to program a microprocessor system.
- Elucidate the microcontroller basics and showcase its applications.

**CSC 2212 ANALYSIS OF ALGORITHMS**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**OBJECTIVES :**

- To learn the asymptotic performance of algorithms.
- To synthesize efficient algorithms in common engineering design situations.
- To familiar with good principles of algorithm design.
- To understand different algorithmic design strategies.
- To know the limitations of Algorithm Power.
- To define the classes P and NP and explain the significance of NP-completeness.

**MODULE I FUNDAMENTALS OF ANALYSIS OF ALGORITHM 08**

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

**MODULE II BRUTE FORCE AND DECREASE AND CONQUER 08**

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

**MODULE III DIVIDE AND CONQUER AND TRANSFORM AND CONQUER 08**

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

**MODULE IV DYNAMIC PROGRAMMING AND COMPUTATIONAL COMPLEXITY 07**

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

**MODULE V GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT** **07**

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes – The Simplex Method – The Maximum Flow Problem – Maximum Matching in Bipartite Graphs.

**MODULE VI COPING WITH THE LIMITATIONS OF ALGORITHM POWER** **07**

Lower Bound Arguments – Decision Trees – P,NP and NP Complete Problems – Challenges of Numerical Algorithms – Backtracking – Branch and Bound – Approximation Algorithms for NP Hard Problems – Algorithms for Solving Non Linear Equations.

**L-45 ; T-15; TOTAL HOURS-60**

**REFERENCES :**

1. Anany Levitin,"The Design and Analysis of Algorithms",Pearson Education Limited,Third Edition,ISBN 10:0-273-76411-X,ISBN 13:978-0-273-76411-3, 2012.
2. Rajesh K.Shukla,"Analysis and Design of Algorithms",Wiley India Private Limited,ISBN : 978–81-265-5477-5,ISBN:978-81-265-8214-3, 2015.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein," Introduction to Algorithms", MIT Press,Third Edition, ISBN: 978-0-262-03384-8,ISBN: 978-0-262-53305-8, 2009.
4. Sahni Horowitz,"Fundamentals of Computer Algorithms,University Press, ISBN-10:8173716129,ISBN-13:978-8173716126, 2008.

**OUTCOMES:**

Students who complete this course will be able to

- Analyze best case, average case and worst-case running times of algorithms using asymptotic analysis.
- Apply design principles and concepts to algorithm design.
- Identify and analyze criteria and specifications appropriate to new problems, and choose the appropriate algorithmic design technique for their solution.
- Have the mathematical foundation in analysis of algorithms.
- Develop new data structures by augmenting existing data structures and design algorithms that employ data structures.
- Design algorithms using the Divide-and-Conquer, Dynamic Programming strategy and recite algorithms that employ this strategy.

**CSC 2213 NETWORK SECURITY AND CRYPTOGRAPHY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- Provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- Cram the various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- Acquainted with Digital Signature Standard and provide solutions for their issues.
- Familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel
- Introduce the remote User Authentication Principle, symmetric and asymmetric encryption
- Focuses on the practical applications that have been implemented and are in use to provide email and web security.

**MODULE I INTRODUCTION TO COMPUTER AND NETWORK SECURITY** **07**

Computer and Network Security concepts – The OSI Security Architecture – Security attacks – Security Services – Security Mechanisms – Fundamental Security Design Principles – Attack surfaces and Attack Trees – Introduction to Number Theory – Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic Prime Numbers – Femat's and Euler's Theorem – The Chinese Remainder Therom

**MODULE II SYMMETRIC CIPHERS** **07**

Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography – Block Ciphers and Data Encryption Standard – Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Strength of DES – Block Cipher Design Principles- Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Code book – Cipher Block Chaining Mode – Cipher Feedback Mode 0 Output Feedback Mode – Counter Mode

**MODULE III ASYMMETRIC CIPHERS** **07**

Public- Key Cryptography and RSA – Principles of Public Key Cryptosystem – RSA Algorithm – Diffie-Hellma Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve

Cryptography – Pseudo Random Generation

**MODULE IV CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS 08**

Cryptographic Hash Functions – Applications of Cryptographic Hash functions – Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm (SHA) – Message Authentication Codes – Message Authentication Requirements – Message Authentication Functions – Security of MACs-HMAC – MACs Based on Block Ciphers : DAA and CMAC – Digital Signatures – Elgamal, Schnorr , NIST, Elliptic, RSA-PSS Digital Signature.

**MODULE V MUTUAL TRUST 07**

Key Management and distribution – Symmetric Key Distribution using Symmetric Distribution – Public Key infrastructure – User authentication – Remote User Authentication Principle – Kerberos – Remote User Authentication using symmetric and Asymmetric Encryption

**MODULE VI NETWORK AND INTERNET SECURITY 09**

Network Access Control and Cloud Security – Transport Kevel Security – Wireless Network Security – Electronic Mail Security - IP Security

**L-45 ; TOTAL HOURS-45**

**REFERENCES :**

1. Williams Stallings, “Cryptography and Network Security: Principles and Practice “,Pearson Education, 7th Edition, ISBN: 10:1-292-15858-1, 2016.
2. Manuel Mogollon, “Cryptography and Security Services: Mechanisms and Applications “, Cybertech Publishing, 1st Edition, ISBN-13: 978-1599048376, 2008.
3. Mike Speciner, Radia Perlman ,“Network Security: Private Communications in a Public World”, , Pearson Education, 2nd Edition, ISBN: 0-13-046019-2, 2002.
4. Christof Paar; Bart Preneel; Jan Pelzl,”,Understanding Cryptography : a Textbook for Students and Practitioners”, Springer, e-ISBN: 978-3-642-04101-3, 2014

**OUTCOMES :**

Students who complete this course will be able to

- Impart knowledge on Encryption techniques, Design Principles and Modes of

Operation.

- Design a security solution for a given application
- Devise the Key Management techniques and Number Theory.
- Create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
- Examine the issues and structure of Authentication Service and Electronic Mail Security
- Provide familiarity in Intrusion detection and Firewall Design Principles.

**CSC 2214 DATABASE MANAGEMENT SYSTEMS**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To identify the role of a database management system in an organization.
- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To study SQL and relational database design.
- To learn the internal storage structures and schema.
- To study the relational algebra operations.
- To learn the ACID properties in transaction management.

**MODULE I INTRODUCTION** **08**

Introduction - An example - Characteristics of Database approach – Roles of database users - Advantages of using DBMS approach - Database applications - Data models, schemas and instances - Three-schema architecture and data independence - Database languages and interfaces - The database system environment - Centralized and client-server architectures - Classification of Database Management systems.

**MODULE II RELATIONAL MODEL AND RELATIONAL ALGEBRA** **10**

Relational Model: Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions and dealing with constraint violations - Basic Retrieval queries in SQL - Insert, Delete and Update statements in SQL - Additional features of SQL - More Complex SQL Retrieval Queries - Unary Relational Operations: SELECT and PROJECT - Relational Algebra Operations from Set Theory - Binary Relational Operations: JOIN and DIVISION.

**MODULE III ER MODEL AND TRANSACTION MANAGEMENT** **12**

Entity Types, Entity Sets, Attributes and Keys - Relationship types, Relationship Sets, Roles and Structural Constraints - Weak Entity Types - Refining the ER Design -ER Diagrams, Naming Conventions and Design Issues – Transaction Management - ACID Properties – Transaction Schedules.

**L – 30; TOTAL HOURS-30**

**REFERENCES :**

1. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Addison-Wesley, ISBN: 978-0133970777,2015.

2. Silberschatz, Korth and Sudharshan, "Data Base System Concepts", 6th Edition, Mc-GrawHill, ISBN: 978-0073523323, 2010.
3. Raghu Ramakrishnan and Johannes Gehrke,"Database Management Systems", 3rd Edition, McGraw-Hill,ISBN: 978-9339213114, 2014.
4. C.J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, ISBN: 978-8131762660, , 2012 .

**OUTCOMES :**

Students who complete this course will be able to

- Describe fundamental elements of a relational database management system.
- Transform an information model into a relational database schema.
- Demonstrate any database applications using ER diagrams.
- Use the Data base model based on the application.
- Write complex queries to solve the real world problems.
- Compare the various transaction schedules.

| CSC 2215 | DBMS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES :**

- To learn the concepts of Database Management systems.
- To create, update and query with the data in the databases.
- To make a detailed study on the applications of DBMS.
- To access and manipulate data using PL/SQL blocks.
- To familiarize advanced SQL queries.
- To learn JDBC/ODBC connectivity.

**LIST OF EPERIMENTS:**

**SQL:**

1. Creating, altering and dropping tables with integrity constraints using DDL commands.
2. Retrieving and modifying data from a database using DQL and DML Statements.
3. Retrieving data from database using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING clause.
4. Use of scalar and aggregate functions.
5. Retrieving data from a database using Join operations(Inner and Outer Joins).
6. Using sub queries or complex queries for retrieving data.

**PL/SQL:**

7. Simple PL/SQL Programs.
8. Use of implicit & explicit cursors in data handling.
9. Use of stored procedures & functions in data manipulation.
10. Use of trigger in data manipulation.

**APPLICATION DEVELOPMENT ( JDBC/ODBC connectivity)**

a) Inventory Control System.

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Blood Donors Information Management System.

f) Web Based User Identification System.

g) Timetable Management System.

h) Hotel Management System

**SOFTWARES:**

- Front end: VB/VC ++/JAVA or Equivalent
- Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent.

**TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Design and implement a database schema for a given problem-domain.
- Populate and query a database using SQL DML/DDL commands.
- Apply the normalization techniquesto a database.
- Create simple applications using Java and Oracle using JDBC connectivity.
- Create and maintain tables using PL/SQL.
- Build applications using VB and Oracle.

| CSC 2216 | SECURITY LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES :**

- To study and implement simple security algorithm
- To understand the concept of public key encryption, its implementation and real time applications
- To know the symmetric algorithms, and its real time applications
- To identify the various applications of cryptography and security issues practically
- To analyze the different security parameters by installing the security tool kits
- To familiar with S/MIME for e-mail communication

**SOFTWARE REQUIRED : C/C++/JAVA**

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

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

**TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Implement Symmetric and asymmetric algorithms
- Install the different security toolkits and analyze various parameters
- Demonstrate Intrusion Detection System and Digital signatures using tool kits
- Generate password hashes with security toolkits
- Monitor flow of information in the network and look for vulnerability
- Configure the firewall to block the system and verify the correctness of the system

**SEMESTER V**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **MSB 3181** | **LEADERSHIP & CEO TRAINING** | **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 traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

**MODULE II LEADERSHIP STYLE AND COMMUNICATION 08**

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 08**

**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 09**

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 08**

**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.

**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.

**L – 45; 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

**MSB 3182 SOCIAL ENTREPRENEURSHIP L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

**MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07**

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

**MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07**

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

**MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07**

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

**MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08**

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

**MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

**MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY** **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

**L – 45; Total Hours – 45**

**REFERENCES:**

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

**OUTCOMES:**

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

| ENC 3181 | COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE | L | T | P | C |
|---|---|---|---|---|---|
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**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.

**CSC 3101 OPERATING SYSTEMS L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To know the objectives, functions and architecture of operating systems.
- To understand process management concepts.
- To study the functions of process concurrency and synchronization .
- To provide knowledge about how the memory management is done with the help of operating systems.
- To learn the techniques for managing the I/O devices.
- To illustrate techniques for managing the files.

**MODULE I OVERVIEW OF OPERATING SYSTEMS 08**

Operating Systems Objectives and Functions - Evolution of the Operating systems - Operating System Structures.

**MODULE II PROCESS MANAGEMENT & SCHEDULING 08**

Process Life cycle - Process control - Threads - Multi Threads - Scheduling criteria - Types of scheduling - Scheduling Algorithms.

**MODULE III PROCESS SYNCHRONIZATION 07**

Concurrent process - Principles of Concurrency - IPC - Semaphores – Deadlock - Deadlock Prevention, Avoidance, Detection and recovery.

**MODULE IV MEMORY MANAGEMENT 07**

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

**MODULE V I/O MANAGEMENT 07**

Organization of I/O functions - Evolution of I/O Functions - Logical Structure of I/O functions - I/O Buffering and Blocking

**MODULE VI DISK SCHEDULING 08**

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

**TOTAL HOURS-45**

**REFERENCES :**

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

**OUTCOMES :**

Students who complete this course will be able to

- State the functioning of operating systems
- Compare the performance of various process scheduling algorithms.
- Analyze the implementation of processes and problems related to process synchronization.
- Find how to manage the resources like memory, I/O devices and files.
- Compare the functioning of various operating systems.
- Compare the functioning of various scheduling algorithms.

**CSC 3102 WEB DEVELOPMENT USING JAVA L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To understand the importance of the web as a medium of communication.
- To learn the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To develop skills in analyzing the usability of a web site.
- To become familiar with popular search engine.

**MODULE I INTRODUCTION 08**

Declaring Variables - Programming in Java - Operator and control structures- Functions - Packages and Interfaces - Exception Handling. Java I/O streaming - Filter and pipe streams - Byte Code interpretation - Threading -Swing - Internet and web Trends.

**MODULE II XHTML & CSS 07**

XHTML Introduction- Body and Text basics- List basics – Text Formatting-Hyperlink-CSS Overview- Configuring Color with embedded style sheet - Configuring Text-Centering XHTML elements with CSS.

**MODULE III WEB DESIGN 08**

Website Organization & Navigation – Design Principles- Web Page Design – Page layout Design Techniques – Text Design – Graphics Design.

**MODULE IV WEBSITE DEVELOPMENT 08**

Server side programming - Servlets - Java Server Pages - JDBC - Development Process- Domain name overview – Web Hosting – Choosing Virtual Host.

**MODULE V WEB MULTIMEDIA & INTERACTIVITY 07**

Helper Applications – Multimedia file types – Using Sound on a Web Page – Using Video on Web Page – podcasting overview – Adobe flash in web page- Java in web page.

**MODULE VI WEB PROMOTION 07**

Search Engine Overview – Popular Search Engine – Components of Search Engine – Designing pages for Web promotion – Social Media Organization – Case Study: Car

loan, Interior Design.

**TOTAL HOURS-45**

**REFERENCES :**


1. Herbert Schildt,"JAVA: The Complete Reference", McGraw Hill Education Pvt Ltd, 9th Edition, ISBN: 9780071808569, 2014.
2. Terry Felke, Morris,"Web Development and Design Foundations with HTML5", Pearson Publication, Eighth Edition, ISBN: 9780134323589, 2016.
3. Sandeep Kumar Patel,"Developing Responsive Web Applications with AJAX and jQuery", Packt publishing, 1st edition, ISBN: 978-1-78328-637-9, 2014.
4. AchyutGodbole, AtulKahate, "Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing", McGraw Hill Education Pvt Ltd, Third edition, ISBN: 978129062681, 2013.
5. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, "Building Web Services with Microsoft Azure", Packt publishing, first edition, ISBN: 978-1-78439-8, 2015.
6. Jennifer T. Campbell, "Web Design: Introductory", Shelly Cashman Series, 5th Edition, ISBN: 978-1285170626, 2017.


**OUTCOMES :**

- Students who complete this course will be able to
- Use fundamental skills to maintain web server services required to host a website.
- Design and develop basic web pages using XHTML and CSS.
- Select and apply markup languages for processing, identifying, and presenting of information in web pages.
- Apply scripting languages and web services to transfer data and add interactive components to web pages.
- Create and manipulate web media objects using editing software.
- Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations.

**CSC 3103 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To introduce the fundamentals of artificial intelligence.
- To focus on knowledge representation and reasoning techniques.
- To equip the student on machine learning problems and applications.
- To provide understanding on the machine learning architecture for big data.
- To gather knowledge on the installation of various machine learning tools.
- To have a deeper knowledge on the types of learning based on tools.

**MODULE I PRODUCTION SYSTEMS AND AI 8**

Production systems, specialized production systems, types of production systems, search strategies for AI production systems, backtracking strategies, graph search strategies, uninformed graph search, heuristic graph search, related algorithms, and measures of performance.

**MODULE II DECOMPOSABLE PRODUCTION SYSTEMS 8**

AND/OR graphs, AO* a heuristic procedure for AND/OR graphs, relationship between decomposable and commutative systems, searching game trees, predicate calculus in AI, resolution, use of predicate calculus in AI, resolution refutation systems, control strategies for resolution methods, simplification strategies, extracting answers from resolution refutations.

**MODULE III RULE BASED DEDUCTION SYSTEMS 8**

A forward deduction systems, backward deduction systems, resolving within AND/OR graphs, computation deduction and program synthesis, control knowledge for rule based deduction systems, basic plan generating systems, robot problem solving, forward production systems, representation of plans, backward production systems, STRIPS, using deduction systems to generate robot plans.

**MODULE IV MACHINE LEARNING OVERVIEW 8**

Introduction to machine learning – machine learning applications – supervised learning – learning class with example – learning multiple classes – model selection and generalization – Dimensions of supervised machine learning algorithm.

**MODULE V MACHINE LEARNING MODELS 8**

Statistical learning framework model – unsupervised learning – PAC learning – a more general learning model – uniform convergence for learnability – non uniform learnability – structural risk minimization – run time of learning.

**MODULE VI ADVANCED LEARNING MODELS 5**

Online learning – realizable and unrealizable case – clustering – generative models – Feature selection and generation – feature selection – feature manipulation and normalization – feature learning.

**L - 45; TOTAL HOURS-45**

**REFERENCES :**

1. Nils J. Nilsson, “Principles of Artificial Intelligence”, 1 st Edition, Morgan Kauffman publishers, ISBN: 1483295869 2014.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, ISBN 9780262028189, 2014.
3. Shai Shalev - Shwartz, Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, ISBN 9781107057135, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Identify the production systems and the search strategies.
- Acquire knowledge on the representation and reasoning techniques.
- Have an exposure on machine learning problems and applications.
- Examine the learning applications for machine learning
- Examine the installation of machine learning tools and its packages.
- Address the types of learning based on machine learning tools.

**CSC 3104** **WEB DEVELOPMENT LAB** **L T P C**

**0 0 2 1**

**OBJECTIVES :**

- To develop a web application using java technologies.
- To discover the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To expand skills in analyzing the usability of a web site.
- To become familiar with web application and development careers.

**SOFTWARE REQUIRED :**

Basic tools : Java JDK 1.6 and above ,AJAX ,MySQL ,Dream Weaver, Apache Server

**LIST OF EXPERIMENTS:**

1. Applications form for B.E/B.TECH Admission using Java.
2. Study of Layout Controls.
3. Color Palette Applications.
4. Webpage Design using Image Mapping.
5. Webpage Design Using Style sheet.
6. Designing and Validating Bio-Data using HTML Script.
7. JDBC Connectivity.
8. Invoking HTML forms by Servlets.
9. Servlet with JDBC Connectivity.
10. Employee Payroll System using Java Servlet

**TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Define modern protocols and systems used on the Web such as HTML.
- Apply client-server internet approaches to web design and implementation.
- Design and implement interactive web sites.
- Apply scripting languages and web services to transfer data and add interactive components to web pages
- Justify and explain particular internet application concepts, relevant alternatives and decision recommendations, including design considerations for internet security.

- Conceptualize and plan an internet-based business that applies appropriate business models and web technologies.

**SEMESTER VI**

| | | | | | |
|---|---|---|---|---|---|
| **ENC 3281** | **COMMUNICATION AND SOFT SKILLS - II** | **L** | **T** | **P** | **C** |
| | **CONFIDENCE BUILDING** | **0** | **0** | **2** | **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.

**CSC 3211 BIG DATA ANALYTICS L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To provide the basics of data science and Hadoop architecture.
- To construct streaming framework and execute programs with MapReduce.
- To provide the basics of design patterns and learn the basics of Spark programming.
- To formulate queries and evaluate using Hive and HBase.
- To ingest data and work on Sqoop.
- To expose higher level APIs and apply machine learning techniques in Big data .

**MODULE I OPERATING SYSTEM FOR BIG DATA 08**

Data products – Hadoop for data products – Hadoop eco system – Big data workflows – Hadoop architecture – Hadoop cluster – HDFS – Working with distributed file System – MapReduce – Hadoop Installation.

**MODULE II PYTHON AND HADOOP STREAMING 07**

Hadoop streaming – computing on CSV data with streaming – executing streaming jobs – MapReduce with Python – simple tasks on MapReduce – counting bigrams – Advanced MapReduce – Combiners – Partitioners – Job Chaining

**MODULE III COMPUTING WITH SPARK AND DESIGN PATTERNS 08**

Spark Basics – Spark Stack – Resilient Distributed Data Sets – working with Resilient Distributed Data Sets – Interactive Spark – Writing Spark applications. Computing with keys – Compound keys – Keyspace patterns – Pairs Vs Stripes – Design patterns – Summarization – Indexing – Filtering – Fitting and validating models.

**MODULE IV DATA MINING FOR LARGE DATA SETS 07**

Data Mining basics - Structured data queries with Hive – Hive Command line Interface – Hive query language – simple problem solving - data analysis with Hive – HBase – Real time data Analytics with Hive.

**MODULE V DATA IMPORT AND QUERYING 05**

Importing relational data with Sqoop – MySQL to HDFS – MySQL to Hive – MySQL to HBase – Ingesting streaming data with Flume.

**MODULE VI HIGHER LEVEL APIs AND MACHINE LEARNING 10**

Pig – Pig Latin – Data Types – Relational operators – User defined functions – Spark's higher level APIs – Spark SQL – Spark SQL – Data Frames. Machine learning with Spark – Collaborative filtering – Classification – Clustering – Machine learning life cycle.

**; TOTAL HOURS- 45**

**REFERENCES :**

1. Benjamin Bengfort , Jenny Kim, "Data Analytics with Hadoop", O'Reilly Media, Inc., First edition, ISBN: 9781491913734, 2016.
2. Isaac D. Cody, "Data Analytics and Python Programming: Beginners Guide to Learn Data Analytics, Predictive Analytics and Data Science With Python Programming, CreateSpace Independent Publishing Platform, First edition, ISBN-13: 9781541334571, 2016.
3. Sam R. Alapati, "Expert Hadoop Administration: Managing, Tuning, and Securing Spark, YARN, and HDFS", Addison Wesley Publishers, First edition, ISBN-13: 9780134597195, 2016.

**OUTCOMES :**

Students who complete this course will be able to

- Relate to data science and state the working of Hadoop architecture
- Design and implement simple streaming framework and work on MapReduce based problem solving.
- Choose a real time problem, design the analytic logic and solve using Spark.
- Construct queries and evaluate using Hive and HBase.
- Apply various techniques of data ingestion and perform analytics on them.
- Be able to solve data analytics case studies applying machine learning techniques.

**CSC 3212 DISTRIBUTED COMPUTING**

| L | T | P | C |
|---|---|---|---|
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**OBJECTIVES :**

- To identify the fundamental principles to design basic distributed systems.
- To describe about the various distributed computing paradigms for Client-Server communication based on the application.
- To analyze the key issues related to communication across a distributed infrastructure and across multiple heterogeneous resources.
- Illustrate the principles of naming and coordinating distributed systems and evaluate the effectiveness and shortcomings of this solution.
- To interpret how various identify and apply design principles when consistency and replication is addressed in architecture.
- To recognize and analyze the failure detection algorithms for fault tolerance and how recovery from failure can be carried out.

**MODULE I DISTRIBUTED COMPUTING ARCHITECTURE 08**

Design goals-Types of distributed system-Architecture styles-Middleware organization-System architecture.

**MODULE II PROCESSES 08**

Threads-Virtualization-Clients-Servers-design issues-object servers-Code migration-Migration in heterogeneous systems.

**MODULE III COMMUNICATIONS 08**

Layered protocols-Types of communication-Remote procedure call-Message oriented communication-Multicast communication.

**MODULE IV NAMING AND CO-ORDINATION 07**

Flat naming-Structured Naming-Attribute-based naming-Clock synchronization-Logical clocks-Mutual Exclusion-Election Algorithms-Distributed event matching-Gossip based coordination.

**MODULE V CONSISTENCY AND REPLICATION 07**

Introduction-Data-Centric consistency models- Client-Centric consistency models-Replica management-Consistency protocols-Caching and replication in web.

**MODULE VI FAULT TOLERANCE AND SECURITY 07**

Failure Models-Process resilience-Reliable client-server communication-Reliable group communication-Distributed commit-Recovery-Security threats-Cryptography-Secure channel-Access control-Secure Naming-Security Management.

**TOTAL HOURS-45**

**REFERENCES :**

1. Andrew S Tanenbaum, Maartenvan Steen, "Distributed Systems – Principles and Paradigms", 2nd Edition, Pearson Education,ISBN=1543057381, 2017.
2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, ISBN=8120313801,2008
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, ISBN=0321263545,2009
4. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms and Systems", Paperback Edition, Cambridge University Press, ISBN=1139470310, 2011.

**OUTCOMES :**

Students who complete this course will be able to

- Recognize the design principles underlying the functioning of distributed systems.
- Design a distributed system and migrate process when required.
- Apply various communication algorithms and techniques to distributed system environment.
- Build distributed system environment using various naming strategies and coordination techniques based on application.
- Improve the performance and reliability of distributed programs analyzing various security factors.
- Describe and distinguish synchronization and concurrency control for a parallel or distributed computing system.

**CSC 3213 GRAPH THEORY AND APPLICATION L T P C**

**3 1 0 4**

**OBJECTIVES :**

- To introduce the students to graphs and their properties.
- To introduce graph applications as models of networks
- To improve the ability to use recursive definitions and solve recurrence relations.
- To deal with non-polynomial time graph problems.
- To impart knowledge on applying graph algorithms in the domain of Computer Science.
- To apply concept of graph theory to represent and use in communication networks.

**MODULE I INTRODUCTION TO GRAPHS 08**

Fundamentals of Graph Theory - Families of Graphs and Digraphs - History of Graph Theory – Graph Representation

**MODULE II GRAPH THEORY 07**

Graph Isomorphism - Recursively Constructed Graphs - Structural Graph Theory - Directed Graphs - Basic Digraph Models and Properties - Directed Acyclic Graphs – Tournaments.

**MODULE III CONNECTIVITY AND REVERSIBILITY 08**

Connectivity: Properties and Structure - Eulerian Graphs - Chinese Postman Problems - Hamiltonian Graphs - Traveling Salesman Problems - High Connectivity – Bounded Connectivity.

**MODULE IV COLORINGS 08**

Graph Coloring - Independence and Cliques - Factors and Factorization - Applications to Timetabling - Graphs in Computer Science – Searching - Dynamic Graph Algorithms - Algorithms on Recursively Constructed Graphs - Fuzzy Graphs.

**MODULE V GRAPHS IN COMPUTER SCIENCE 08**

Searching - Dynamic Graph Algorithms - Dynamic Problems on Undirected Graphs - Dynamic Problems on Directed Graphs - Drawings of Graphs - Types of Graphs and Drawings - Combinatorics of Some Geometric Graphs - Properties of Drawings and Bounds - Complexity of Graph Drawing Problems.

**MODULE VI NETWORKS AND FLOWS 06**

Maximum Flows - The Basic Maximum Flow Problem - Minimum Cuts and Duality - Max-Flow Min-Cut Theorem - Algorithms for Maximum Flow - Variants and Extensions of Maximum Flow - Minimum Cost Flows - The Basic Model and Definitions - Residual Networks - Optimality Conditions - The Dual Problem - Algorithms for Minimum Cost Flow - Extensions to Minimum Cost Flow - Matchings and Assignments.

**L – 45; T-15; TOTAL HOURS-60**

**REFERENCES :**

1. "Handbook of Graph Theory", Ping Zhang, Jay Yellen, Jonathan L. Gross, Chapman and Hall/CRC, 2nd Edition, ISBN: 9781439880197, 2015.
2. "Advanced Graph Theory and Combinatorics, Michel, John Wiley & Sons, ISBN: 9781848216167, 2016.
3. "Algorithmic Graph Theory and Perfect Graphs", Martin Charles Golumbic, North Holland, 2nd Edition, ISBN: 9780444515308, 2004.

**OUTCOMES :**

Students who complete this course will be able to

- Formulate problems in terms of graphs.
- Solve graph theoretic problems and apply algorithms taught in the course.
- Use generating functions to solve a variety of combinatorial problems.
- Identify the biconnected components in a graph or a circuit.
- Apply principles and concepts of graph theory in practical situations
- Apply concepts of graph theory in Computer networks.

| CSC 3214 | BIG DATA ANALYTICS TOOLS LAB | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES :**

- To provide the basic understanding of Hadoop eco system
- To create a Hadoop working environment
- To execute simple programs in Hadoop.
- To write Python programs for solving problems by MapReduce.
- To give basics of Spark programming principles.
- To establish database connectivity and perform analytics on the imported data.

**LIST OF EXERCISES:**

1. Hadoop Installation.
2. Simple program execution on Hadoop.
3. Python basic programming.
4. MapReduce problem using Python.
5. Simple programs using Spark.
6. Database connectivity and query evaluation using HBase and Hive.
7. Case studies on data analytics using real world Data with suitable Big data open source tools and presentation with effective visualization of analytics.

**P-15;TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Establish the Hadoop working environment.
- Test working of simple programs on Hadoop.
- Develop programs in Python for performing data analytics.
- Analyze and MapReduce a given problem and solve it in Hadoop.
- Design and develop programs in Spark.
- Carry out data analytics on big data collected from real time scenarios.

| CSC 3215 | MOBILE APPLICATION DEVELOPMENT LAB | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES :**

- To expose the various mobile development environments.
- To study the user interface design in mobile applications.
- To inculcate the graphical design for mobile application.
- To restate the concept of multi threading in mobile environment.
- To provide insight about Client-Server communication in mobile environment.
- To be acquainted with database connectivity in the mobile application.

**SOFTWARE REQUIRED : J2ME/Android Studio/iOS/Windows phone/Equivalent Mobile Application Development tools with Emulators and Debuggers**

1. To implement User Interface features
2. To develop Layout designs and Action Listeners in mobile devices
3. To create a simple calculator application
4. To implement graphical design in mobile applications
5. To connect applications to databases in the device
6. To access RSS Feeds from web
7. To develop mobile application that implements Multi threading
8. To establish Client-Server communication
9. An application development-Mini Project

**P-15;TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Develop mobile application using any mobile application development tool.
- Design good graphical interface for any mobile application.
- Apply action listeners for the buttons in the mobile application.
- Implements database connectivity to the mobile application.
- Devise a mobile application that uses the concept of multithreading.
- Create a mobile application that supports web access.

**SEMESTER VII**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CSC 4101** | **SOFTWARE PROJECT MANAGEMENT** | **3** | **0** | **0** | **3** |

**OBJECTIVES :**

- Learn the basic of software project management and the project planning.
- Evaluate and assess the projects and to find the cost of the project using cost benefit evaluation techniques.
- To highlight different techniques for software cost estimation and activity planning.
- It also help identify the risks involved in the project and the appropriate strategies for minimizing potential risks.
- Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication and change management.
- Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.

**MODULE I INTRODUCTION 08**

Software projects versus other types of project - Contract management and technical project management- Plans, methods and methodologies -categorizing software projects -Stakeholders - The business case - Requirement specification - Management control - Step Wise project planning.

**MODULE II PROJECT EVALUATION 07**

Strategic assessment - Technical assessment - Cost–benefit analysis - Cash flow forecasting - Cost–benefit evaluation techniques - Risk evaluation.

**MODULE III SOFTWARE PROJECT APPROACH 07**

Choosing technologies - Technical plan contents list - The waterfall model - The V-process model - The spiral model - Software prototyping - Incremental delivery - Dynamic Systems Development Method - Extreme programming..

**MODULE IV EFFORT ESTIMATION AND ACTIVITY PLANNING 08**

Problems with over- and under-estimates -Software effort estimation techniques - Albrecht function point analysis - A procedural code-oriented approach - COCOMO: a

parametric model - The objectives of activity planning -Project schedules and activities - Network planning models - The forward pass - The backward pass - Identifying the critical path and activities.

**MODULE V RISK MANAGEMENT AND MONITORING 08**

Introduction - The nature of risk - Types of risk - Managing risk - Hazard identification - Hazard analysis - Risk planning and control- Evaluating risks to the schedule- Creating the framework - Collecting the data - Visualizing progress - Cost monitoring - Earned value - Prioritizing monitoring -Getting the project back to target - Change control- Types of contract - Stages in contract placement - Typical terms of a contract - Contract management – Acceptance.

**MODULE VI ORGANIZING TEAMS AND SOFTWARE QUALITY 07**

Understanding behavior- Organizational behavior-- Selecting the right person for the job - Instruction in the best methods -The Oldham–Hackman job characteristics model - Decision making - Leadership -Organizational structures - software quality in project planning -Practical software quality measures- Product versus process quality - Quality plans.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi,. ISBN= 9780077122799,2012
2. Robert K.Wysocki “Effective Software Project Management” –Wiley Publication. ISBN=1118089243,2011
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998. ISBN=0321734025,1998
4. Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India),. ISBN=1259007111,2013

**OUTCOMES :**

Students who complete this course will be able to

- Practice Project Management principles while developing a software.
- Demonstrate effective project execution and control techniques that result in successful projects.
- Conduct project closure activities and obtain formal project acceptance.
- Demonstrate a strong working knowledge of ethics and professional

responsibility.

- Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
- Critical-thinking and analytical decision-making capabilities to investigate complex business problems to propose project-based solutions

**CSC 4102** **COMPILER DESIGN** **L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To outline the history and algorithms for compiler construction.
- To introduce high-level programming language implementation.
- To provide fundamental principles of compiler design.
- To have an in-depth knowledge of inner process of compiler.
- To understand the workings of and add to a language processor for each of the modern paradigms.
- To give knowledge on writing programs using compiler construction tools.

**MODULE I INTRODUCTION 07**

Introduction – A simple traditional modular compiler/interpreter – Structure of compiler – Compiler architecture – Properties of good compiler- History of Compiler Construction – Grammar- Closure algorithm.

**MODULE II LEXICAL ANALYSIS 08**

Reading the program text – Regular expressions and regular descriptions – Creating lexical analysis by hand and by automatically – Transition table compression – Error handing in lexical analyzers – Lexical identification of tokens – Macro processing and file inclusion.

**MODULE III SYNTAX ANALYSIS 09**

Two classes of parsing methods – Error detection and error recovery – Creating top down parser manually and automatically – LL(1) parsing – Creating bottom up parser automatically – SLR (1) parsing – LR(1) parsing – LALR (1) parsing – Recovering grammars from legacy code.

**MODULE IV SEMANTIC ANALYSIS AND INTERMEDIATE CODE 06**

Types and types checking – Storage management – Syntax directed translation – Intermediate code - Assemblers, Dissemblers, Linkers and Loaders.

**MODULE V CODE GENERATION 08**

Optimization techniques – Local Optimization and Basic blocks – Control and data flow - Code generation – Target machines – Register allocation – Stack management –

Automatic Code generation construction.

**MODULE VI COMPILER CONSTRUCTION TOOLS 07**

Implementation issues – Cross compilation – Implementation languages – Compiler construction tools – Structure – Simple programs.

**TOTAL HOURS-45**

**REFERENCES :**

1. Des Watson, “A Practical Approach to Compiler Construction”, Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

**OUTCOMES :**

Students who complete this course will be able to

- Describe the fundamental steps for designing a compiler.
- Generate tokens for any programming syntax.
- Construct syntax tree and parse the input.
- Implement a translator for a programming language.
- Optimize the code using the techniques provided.
- Use compiler construction tools such as LEX/FLEX and YACC/BISON.

**CSC 4103** **CLOUD COMPUTING** **L T P C**
**3 0 2 4**

**OBJECTIVES :**

- To lay the foundation on various types of cloud services, technologies and service providers.
- To comprehend the technical capabilities and business benefits of virtualization and cloud computing.
- To study the design challenges of cloud infrastructure.
- To have a knowledge on different programming models and cloud software.
- To elaborate on energy efficient, privacy and security issues in cloud environments.
- To study the fundamental concepts of cloud storage and demonstrate their use in storage systems.

**MODULE I CLOUD FUNDAMENTALS 07**

Scalable Computing Service over The Internet - Technologies for Network based Computing - System Models for Distributed and Cloud Computing - Introduction to Cloud Computing – Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -cloud computing vendors.

**MODULE II VIRTUALIZATION 07**

Implementation Levels of Virtualization - Virtualization Structures - Virtualization of CPU, Memory and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Datacenter Automation.

**MODULE III CLOUD INFRASTRUCTURE 08**

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Implementation of resource scheduling algorithm using cloud simulation tool kits

**MODULE IV PROGRAMMING MODEL 08**

MapReduce programming model - MapReduce and extensions – Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - MongoDB - Hadoop - Cloud platforms in Industry – Google App Engine - Cloud Software Environments –Eucalyptus

**MODULE V ENERGY EFFICIENT CLOUD COMPUTING 08**

Energy efficiency in clouds – Green Computing - Energy efficient cloud computing

architecture – energy aware virtual machine placement in data centers -Energy aware dynamic resource allocation – case studies – Implementation of energy aware scheduling algorithm using open source cloud simulation tool kit.

**MODULE VI CLOUD SECURITY AND APPLICATIONS 07**

Cloud security fundamentals- Privacy and Security in cloud - Security Architecture – cloud applications – scientific applications – Healthcare – Geosciences – Social networking - media applications - Multiplayer online gaming.

**L – 45; P – 30; TOTAL HOURS-75**

**REFERENCES :**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, — “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, ISBN : 9780123858801, 2012.
2. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd., ISBN : 9781259029950, 2013
3. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, 2013.
4. Michael J. Kavis “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)” 1st Edition, wiley, ISBN:9781118617618, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Demonstrate the different taxonomy of parallel and distributed computing.
- Articulate the main concepts, key technologies, strengths and limitations of Virtualization and Cloud computing
- Compare and contrast the delivery and deployment models of cloud computing
- Analyze the core issues of cloud computing such as energy efficiency, security, privacy and interoperability
- Recognize the cloud file systems and their applications in industry.
- Identify problems, explain, analyze, and evaluate various cloud computing solutions.

**CSC 4104** **COMPILER LAB** **L T P C**
**0 0 2 1**

**OBJECTIVES :**

- To expose the working of various phases of compiler.
- To introduce various compiler construction tools.
- To illustrate tools to design lexical analyzer and produce a parser for a given grammar.
- To implement various methods for converting three address code to assembly level program.
- To introduce concept of code optimization of three address code for different programming statements.
- To generate assembly code for the input program.

**SOFTWARE REQUIRED :**

Basic tools :C/C++/JAVA, LEX/FLEX, YACC/BISON
Compiler construction tools based on the selection of projects.

**LIST OF EXERCISES:**

1. Design a lexical analyzer for a given High Level Language. Ignore redundant space, tabs and new lines.
2. Study of compiler construction tools.
3. Implement a lexical analyzer.
4. Design and implement Top-Down parsing techniques and Bottom up parsing techniques.
5. Implement a scientific calculator.
6. Generate abstract syntax tree and intermediate code for the given language.
7. Implement code optimization phase of the compiler.

**TOTAL HOURS-15**

**OUTCOMES :**

Students who complete this course will be able to

- Illustrate the working of compiler.
- Design lexical analyzer and generate tokens.
- Parse the string for the given grammar.
- Develop and implement the mathematical operations.
- Construct syntax tree and intermediate code.
- Implement various phases of complier through construction tools.

## ELECTIVE LIST

### SEMESTER IV

### Programme Elective ##1

**CSC X201 MULTIMEDIA AND ANIMATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To introduce the various components of Multimedia.
- To expose the principles of animation and design for developing multimedia applications.
- To adapt professional workflows into the design process of animation industry.
- To effectively create and develop animated content for multimedia projects.
- To develop multimedia content for Hand held devices.
- To develop interactive and animated multimedia content.

**MODULE I MULTIMEDIA 09**

Introduction-Uses of Multimedia-Nyquist's Sampling Theorem-Visual Display Systems-Text-Type of Text- Font, Compression, File formats-Image-Data Representation-Acquisition—Image Processing-Grayscale and Color Processing-Image output on Monitors- Image output on Printers.

**MODULE II GRAPHICS 08**

Components of Graphic System-Transformations-Line and Circle Drawing Algorithm-Filling and Clipping Algorithms-2d modeling-3D Graphics-Transformations-3D Modeling-Quad Tree

**MODULE III VIDEO BASICS FUNDAMENTALS 07**

Animation Principles - Techniques - File Formats - Analog Video -Digital Video-Codecs - Format Converters - Shooting and Editing Videos

**MODULE IV MULTIMEDIA REQUIREMENTS 07**

Stages of Making Multimedia -Intangibles - Multimedia Hardware Requirements-Multimedia Software Requirements - Authoring Systems - Acquiring Content- Internet and Multimedia.

**MODULE V MULTIMEDIA SKILLS 07**

Multimedia Skills - Planning - Costing - Designing - Producing - Talent Acquisition - Delivery Mechanism.

**MODULE VI MULTIMEDIA PROCESS AND TOOLS 07**

Designing for World Wide Web- Designing for Handheld Devices- Macromedia Flash Introduction -Understanding the Interface - Drawing and Color Tools.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Ranjan Parekh",”Principles of Multimedia”, Tata McGraw Hill, 2nd Edition, ISBN: 9780070588332, 2013.
2. Tay Vaughan, "Multimedia: Making It Work”, Tata McGraw Hill, 8th Edition, ISBN: 9780071748469, 2010 .
3. James Gonzalez, "Macromedia Flash Professional 8 Hands-On Training", Peachpit Press,2nd Edition, ISBN: 9780321293886, 2006.

**OUTCOMES :**

Students who complete this course will be able to

- Identify the basic components, basic hardware and software requirements for multimedia development and playback.
- Apply animation principles in Multimedia application development..
- Identify and describe the function of the general skill sets in the multimedia industry..
- Apply animated contents in any Multimedia projects.
- Design Multimedia content for handheld devices.
- Design and create animation using computerized animation tools.

**CSC X202** **VFX** **L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To develop a technical understanding of 3D Modeling, Deformations, and Texturing.
- To explore and utilize Procedural and Bitmapped Shades
- To implement modeling, Deformations and Textures as applied to Lighting & Animation requirements.
- To acquire skills in pipe line motion
- To demonstrate skills in pipe line pixel isolation
- To develop student's aesthetic, intellectual &technological abilities through programs that integrates theory & practical

**MODULE I VFX FUNDAMENTALS 10**

Introduction-The foundation of raster for VFX - The foundation of motion for VFX- The foundation of audio for VFX- The foundation of 2D vector for VFX- The foundation of 3D vector for VFX

**MODULE II VFX SOFTWARES 10**

Fusion vs. Fusion Studio: Two Versions -Fusion Studio: Flow, Stereo 30, Nodes, and Plug-ins- Flow Node Editor: VFX Compositing Tool-The Fusion Bin: using Predefined VFX and Tools

**MODULE III VFX PIPELINE COMPOSITION AND MOTION CONTROL 10**

Adding Imagery: Drag and Drop with File Manager-The Color Correction Tool: Lighten Shadow Levels-Saving a VFX Project Pipeline- Spline Editor: Control Time using Curves-Navigate the Spline Editor: Independent Zooming -Coloring the Spline Editor: Customize Spline Color

**TOTAL HOURS-30**

**REFERENCES :**

1. Wallace Jackson,"VFX Fundamentals: Visual Special Effects Using Fusion 8.0", Apress publications, 1st Edition, ISBN-10: 1484221303, ISBN-13: 978-1484221303,2016.
2. Susan Zwerman , Jeffrey A. Okun ,"The VES Handbook of Visual Effects: Industry

Standard VFX Practices and Procedures Paperback – Import", Focal Press publication; 2 edition, ISBN-10: 0240825187, ISBN-13: 978-0240825182, 2014.

3. Ian Failes ," Masters of FX Paperback – Import", Ilex Press publications, ISBN-10: 1781572674, ISBN-13: 978-1781572672,2015.

**OUTCOMES :**

Students who complete this course will be able to

- Demonstrate creativity, critical thinking and innovation when identifying and solving problems in diverse contexts within the discipline.
- Apply a body of theoretical and practical knowledge and specific skills in media and communication, in which to base your professional practice or future study.
- Examine and discuss the evolution of digital compositing and digital visual effects.
- Critically analyze and discuss the implications of emerging technologies in the visual effects design process.
- Design and develop a range of creative visual effects solutions to design problems.
- Interpret the influence of visual effects in the creation of innovative digital media.

**CSC X203 DIGITAL TRANSMISSION L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To introduce the fundamental components of digital transmission system.
- To provide knowledge about performance objectives the established for digital transmission system.
- To prepare mathematical background for communication signal analysis.
- To expose the working of different digital systems.
- To explore the importance of synchronization in digital transmission.
- To study the performance of digital communication systems.

**MODULE I BASIC TERMINOLOGIES 07**

Principles of System Design – Analog to Digital Conversion Techniques – Pulse Code Modulation – Time Division Multiplexing.

**MODULE II BASEBAND TRANSMISSION 08**

Baseband Transmission – Binary Coding – Power Spectral Density – Error Performance – Pulse Shaping and Inter Symbol Interference – Multilevel Baseband Transmission – Partial Response coding – Eye Patterns – Equalization – Data Scrambling Techniques Modulation Techniques.

**MODULE III DIGITAL TRANSMISSION 09**

Digital Modulation Techniques – ASK- FSK – BPSK – Comparison – M-ary FSK – M-ary PSK – Quadrature Amplitude Modulation – Offset QPSK – Minimum Shift Keying – Quadrature Partial Response – Digital Transmission – Telephone Networks – FDM – Transmission Parameters – Conditioning – Voice Band Modems- Wideband Modems – Transmultiplexers – Hybrid Transmission Systems.

**MODULE IV DIGITAL SYSTEMS 07**

Digital Cable Systems – Introduction – Characteristics – Regenerative Repeaters – Clock Recovery and Jitter – Crosstalk – Error Performance – Repeater Spacing – Implementation – Digital Radio Systems – Line of Path Propagation – Multipath Fading – Frequency Allocation – Interference Effects – Digital Radio Design – Radio Link Calculation.

**MODULE V NETWORK TIMING AND SYNCHRONIZATION 07**

Time Standards – Frequency Sources – Clocks – Synchronization Techniques –

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

**MODULE VI MONITORING AND CONTROL 07**

Performance Monitoring – Fault Isolation – Monitoring and Control System – Future of Digital Transmission – New Digital Services – Technology – Transmission in Local Areas – ISDN.

**TOTAL HOURS-45**

**REFERENCES :**

1. David R.Smith, “Digital Transmission Systems”, Springer, 4th Edition, ISBN 978–1–4757-1187-5, 2013.
2. Simon S. Haykin, “Digital Communication Systems”, Wiley Publications, ISBN 978-0-471-64735-5, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Analyze the different components and their respective roles in communication systems.
- Design a digital system employing the common transmission technologies
- Apply the performance objectives on the designed digital systems.
- Compare and contrast the different technologies applied to digital transmission systems.
- Advice upon choosing appropriate testing strategies employed in signal transmission.
- Identify the practical issues that impact reliable communication in real world scenarios.

**CSC X204 INFORMATION TECHNOLOGY IN ORGANIZATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To describe the role of digital technology in the organizational context.
- To depict the management and flow of data through the digital networks.
- To expose the approachability and management of consumers in organizations.
- To be acquainted with the basics of support systems and enterprise systems in organizations.
- To familiarize the techniques involved in operational and strategic information systems.
- To examine the impacts of Information Technology on individuals, organization and society.

**MODULE I DIGITAL TECHNOLOGY 07**

Technology transformation-Business process management-Competitive advantage and SWOT analysis-Entrepreneurship technology trends-IT expertise-Data governance strategy-Enterprise IT architecture-Information and decision support systems-Data center and cloud computing-Cloud services delivery models.

**MODULE II DATA MANAGEMENT AND DIGITAL NETWORKS 08**

Database Management Systems-Big data and Analytics-Data and Text mining-Business Intelligence-Data Networks and API-Wireless and Mobile Infrastructure-Messaging and collaboration Technology-Sustainability and the triple bottom line.

**MODULE III REACHING & MANAGING CONSUMERS 09**

Search Technology-Organic search and search engine optimization-paid search strategies and metrics-Semantic web and search-recommendation engines-Social media strategies and communities-Social communities and engagement-Social monitoring, metrics and analytics-Social media failures-Retail, mobile and E-commerce.

**MODULE IV SUPPORT SYSTEMS AND STRATEGIC ENTERPRISE SYSTEMS 07**

Business challenges-Manufacturing, production and transportation management systems-Sales and marketing systems-Accounting and finance systems-Human resource systems and ethics-Enterprise systems-Enterprise social platforms-Enterprise resource planning

systems-Supply chain management systems-Customer relationship management system.

**MODULE V** **OPERATIONAL AND STRATEGIC INFORMATION SYSTEMS** **07**

Data visualization-Enterprise data mashups-Digital dashboards-Geographic information systems-IT strategies-IT business alignment-Balanced scorecard method-cloud and vendor strategies-project Management and SDLC.

**MODULE VI** **IMPLEMENTING AND MANAGING IT** **07**

Information Technology for strategic advantage-Information Technology economy-acquiring IT applications and infrastructure-Managing information resources and security-impacts of Information Technology on individuals, organization and society.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Turban, Volonino, Wood,"Information Technology for management", 10th edition, John Wiley and sons Inc., ISBN: 978-1-118-96126-1, 2016.
2. Turban, Leidnar, McLean and Weatherbe, "Information Technology for Management", 5th edition, John Wiley and sons Inc., ISBN: 0-471-705225, 2012.
3. James A O'Brien, George M Marakas, Ramesh Behl, "Management Information Systems", tenth edition, McGraw Hill Education, ISBN 13: 9780073376813, 2013
.

**OUTCOMES :**

Students who complete this course will be able to

- Analyze the various digital technologies and sort out the appropriate one that suits for the IT organization.
- Implement the different techniques in data management and transmits data through digital networks.
- Examine the impact of the internet for enabling companies to become smarter and closer to the consumer.
- Realize the value of enterprise systems in providing a seamless flow of information within the organization.
- Differentiate between operational systems for transaction processing and Information Support Systems for decision-making, and their impact on setting IT priorities and the IT organization.
- Apply information technology in business environments, with consideration of the cultural context of the organizations.

**CSC X205 INNOVATION AND NEW PRODUCT DEVELOPMENT L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To recognize the importance of innovation in organizational context.
- To identify the changing views of innovation over time and innovation management in organization.
- To explore the significance of discontinuous products.
- To restate the new product development process and strategic features of new product development.
- To appreciate strategic thinking and planning abilities throughout the early product design stage.
- To state various techniques for new product planning and market research.

**MODULE I INTRODUCTION TO INNOVATION MANAGEMENT 07**

The importance of innovation - the study of innovation- the need to view innovation in an organizational context-Entrepreneurship-Design-Innovation and invention-Different types of innovations - Technology and science -Popular views of innovation- Models of innovation-Innovation as a management process-Case study: European Innovation Scoreboard.

**MODULE II MANAGING INNOVATION WITHIN FIRMS 07**

Theories about organizations and innovation- The dilemma of innovation management-Managing uncertainty- Organizational characteristics that facilitate the innovation process-Industrial firms are different: a classification- Organizational structures and innovation-Individual's role in the innovation process-IT systems and their impact on innovation-Establishment and propagation of an innovative environment- Case study: Gore-Tex® and W.L. Gore & Associates: An innovative company and a contemporary culture .

**MODULE III INNOVATION AND OPERATIONS MANAGEMENT 07**

Operations management- The nature of design and innovation in the context of operations- Process design and innovation- Innovation in the management of the operations process- Design of the organization and its suppliers- Operations and technology- Case study: Novels- new products and Harry Potter.

**MODULE IV MANAGING INTELLECTUAL PROPERTY 09**

Intellectual property- An introduction to patents- Exclusions from patents-The patenting of

life-Human genetic patenting-The configuration of a patent-Patent harmonization- famous patent cases-Patents in practice-Expiry of a patent and patent extensions- The use of patents in innovation management- Trademarks- Brand names-Using brands to protect intellectual property- Duration of registration- infringement and passing off-Registered designs-Copyright-Remedy against infringement- Cast study: Pricing- patents and profits in the pharmaceutical industry.

**MODULE V** **TECHNOLOGY TRANSFER & NEW PRODUCT DEVELOPMENT** **08**

Introduction to technology transfer-Models of technology transfer-limitations and barriers to technology transfer-Internal organizational factors and inward technology transfer-Developing a receptive environment for technology transfer-Identifying external technology: the importance of scanning and networking-Managing the inward transfer of technology- Product and brand strategy- New product development- Packaging and product development.

**MODULE VI** **MARKET RESEARCH & NPD TEAM MANAGEMENT** **07**

Market research and new product development-The purpose of new product testing-Testing techniques-Influence of market research-Discontinuous new products-Market research and discontinuous new products-hindrance of market research-Technology-intensive products-convention and winning new markets-ignoring customers-balance between new technology and market research-The challenge for senior management-Managing the new product development team -Practical Steps to help Innovation and New Product Development.

**TOTAL HOURS-45**

**REFERENCES :**

1. Paul Trott," Innovation Management and New Product Development", 5th edition, Pearson Education, ISBN-13: 9780273736561, 2012.
2. Crawford C.M.and Di Benedetto C.A.," New Products Management",11th edition, McGraw Hill Education, ISBN-13: 9780078029042, 2015.
3. Joe Tidd- John Bessant- "Managing Innovation: Integrating Technological-Market and Organizational Change", 4th edition, John Wiley & Sons Inc, ISBN 13: 9781118360637, 2013.

**OUTCOMES :**

Students who complete this course will be able to

1. Realize the generation of product concepts that satisfy the needs of customers.

2. Explore and analyze market needs and appreciate their direct relationship with new products.
3. Discover new product opportunities based on the market research.
4. Evaluate the financial, environmental, social and cultural considerations with regard to design decisions.
5. Analyze the performance of the product based on the requirement.
6. Evaluate the business value and impact of the design product in business class

**CSC X206 FUNDAMENTALS OF COMPUTER FORENSICS**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To inculcate the fundamentals of digital forensics from the viewpoint of courtroom legalities.
- To establish forensics concepts on networks and internet.
- To create digital forensics investigator role.
- To elaborate upon the evidence gathering over the internet.
- To gain the knowledge on digital investigations.
- To search the current techniques for forensic examinations.

**MODULE I INTRODUCTION** **10**

Foundations of digital Forensics-Language of Computer Crime Investigation- Digital Evidence in the courtroom-Cybercrime law - Benefits of Professional Forensics Methodology – Types of computer forensics technology.

**MODULE II DIGITAL CRIME** **10**

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

**MODULE III FORENSICS AND NETWORKS** **10**

Network basics for Digital Investigators-Applying Forensic science to Networks- Digital Evidence on the internet, Mobile device forensics, cloud forensics.

**TOTAL HOURS-30**

**REFERENCES :**

1. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet“, Published by Elsevier, 3rd Edition, ISBN: 9780123742681, 2011.
2. Keith John Jones, Richard Bejtlich, Curtis W. Rose, “Real Digital Forensics: Computer Security and Incident Response”, Addison Wesley Professional, 5th edition, ISBN: 9780321240699, 2008.
3. Terrence V. Lillard, Clint P. Garrison, “Digital Forensics for Network, Internet, and

Cloud Computing: A Forensic evidence Guide for Moving Targets and Data", Elsevier, 1st Edition, ISBN: 9781597495370, 2010.

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

**OUTCOMES :**

Students who complete this course will be able to

- Recognize the role of digital forensics in the real world.
- Identify and extract digital evidence from varied networking layers.
- Apply forensics techniques for analyzing computer systems and networks.
- Assess digital evidence and practice forensic investigation.
- Describe the legalities, penalties, and punishment associated with cyber.
- Identify the current techniques and tools for forensic examinations.

**CSC X207 OPEN SOURCE TECHNOLOGIES L T P C**

**2 0 2 3**

**OBJECTIVES :**

- Expose to context and operation of free open source software
- Illustrate the principles of GNU/Linux and distributions
- Explain why Open source technologies are the need of the hour
- Become aware of open source licenses and the processes of adoption and use
- Learn scripting, programming languages like Python and Perl
- Gain knowledge in the concept of open source data base

**MODULE I INTRODUCTION 08**

The concept of software freedom – Modifications – consequences of the freedom of software – Free software before free software – The beginning : BSD,GNU –Free software licences – Free software and public administrations

**MODULE II GNU LINUX 07**

GNU/Linux – Introduction – Installation and File System hierarchy - General Overview – Kernel Mode and User Mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux .

**MODULE III PROGRAMMING LANGUAGUE - PYTHON 08**

Introduction to Python – Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment .

**MODULE IV DATABASE - POSTGRESQL 08**

KeyFeatures of PostgreSQL - Environment Setup - Syntax - Data Types - Working with Databases - Basic operators , Expressions , Queries - Case Study

**MODULE V PHP 07**

Introduction to PHP – Programming in Web Environment – Variables – Constants – Data Type – Operators – Statements – Functions – Arrays – OOP – String Manipulation and Regular Expression – File Handling and Data Storage – PHP and SQL Database – PHP and LDAP – PHP Connectivity – Sending and Receiving E–mails – Debugging and Error Handling – Security – Templates .

**MODULE VI PERL 07**

Perl Backgrounder – Perl Overview – Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines, Packages and Modules – Working with Files – Data Manipulation.

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

**REFERENCES :**

1. Richard Petersen, “Linux: The Complete Reference”,, Sixth Edition 6th Edition, ISBN-13: 978-0071492478,ISBN-10: 007149247X,2016.
2. Sandeep Koranne, “Handbook of Open Source Tools”, Springer, ISBN-13: 978-1441977182, ISBN-10: 144197718X, 2011.
3. KY Cheung, “Scientific Database and Programming Examples Using PHP, MySQL, XML, MATLAB, Python, Perl Hardcover”, Xlibris Corporation, Import, 27 Sep 2011

**OUTCOMES :**

Students who complete this course will be able to

- Ability to install, configure and programming in Linux
- Explain about the open source communities Development Model
- Install and run open source operating systems
- Develop applications in Python and Perl
- Write own MySQL programs and sort the query results
- Develop web applications using open source software

**CSC X208 USER INTERFACE DESIGN L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To expose the relation between interaction design and users expectations.
- To employ a set of usability engineering methods to refine a designed user-interface.
- To learn about human computer interaction with the help of interfaces that has high usability.
- To address a user-interface using suitable evaluation methodology.
- To demonstrates interaction design process.
- To acquire the concepts of usability, design principles, guidelines, heuristics and other fundamentals of Human-Computer Interaction.

**MODULE I INERACTION DESIGN 10**

Introduction, Good and Poor design, Interaction design, User experience, Process of Interaction design, Interaction design and User experience. Understanding the problem space and conceptualizing interaction, Interaction types.

**MODULE II DEVELOPMENT PROCESS 10**

Managing design process – organizational design to support usability – Four pillars of design – development methodologies – Ethnographical observation – Participatory design – scenario development. Develop System Menus and Navigation menus-Select the proper kinds of windows-Select the proper device based controls.

**MODULE III INTERACTION DESIGN 10**

Process of Interaction Design - Establishing Requirements – Design, Prototyping and Construction - Evaluation and Framework. Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation.

.

**TOTAL HOURS-30**

**REFERENCES :**

1. Preece,Sharp & Rogers," Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 4th Edition,ISBN:9781119020752, 2015.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond

Human - Computer Interaction", John Wiley & Sons, 3rd Edition,ISBN 9788131732557, 2011

3. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
4. Bill Scott and Theresa Neil, "designing Web Interfaces", O'Reilly, USA,ISBN: 9780596516253, 2009.
5. Wilbert O.Galitz, "The essential guide to User Interface Design", 3rd Edition, Wiley Publishers,. ISBN: 408-297-2445, 2009.

**OUTCOMES :**

Students who complete this course will be able to

- Demonstrate knowledge about some interaction design patterns and their applicability.
- Select and execute an appropriate interaction design pattern for a particular user interface situation.
- Use several of the important concepts for interface design (i.e. color and typography) in their designs
- Analyze users' needs, usability goals and user experience goals of a small-to-medium-sized software application.
- Develop and construct suitable user interface for a given scenario.
- Implement basic user interface prototypes based on the design process

**CSC X209 STRESS MANAGEMENT L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To bring awareness on the existence of stress in day-today activities.
- To differentiate between obstacles and opportunities.
- To understand the process of confidence building.
- To discriminate the work life activities and instill work life balance.
- To analyze the causes of occupational stress.
- To enumerate the strategies for stress management at work place.

**MODULE I STRESS AND TAMING STRESS 07**

Stress to success, The 50% rule, Obstacles to opportunities, Strategies to reduce workload.

**MODULE II SOLUTIONS FOR STRESS MANAGEMENT 08**

Building confidence, Elimination of Anxiety, Self criticism to self confidence, Anger to a cool head, stop other people stressing you, Work life balance,

**TOTAL HOURS- 15**

**REFERENCES :**

1. Sharon Melnick, “Success Under Stress: Powerful Tools for Staying Calm, Confident, and Productive When the Pressures On”, Amacom Publishers, ISBN-13: 978-0814432129, 2013.
2. D M Pestonjee, “Stress and Work: Perspectives on Understanding and Managing Stress”, SAGE Response publisher, First edition, ISBN-13: 978-8132110880, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Analyze and identify the stress issues in everyday activities.
- Recognize obstacles and opportunities and suggest strategies to utilize the opportunities.
- Create confidence building action plan.
- Assess work life activities and recommend strategies to inculcate work life balance.
- Enumerate the causes of occupational stress and prescribe plans to overcome them.
- Devise simple procedures and plans to minimize stress at work place.

**CSC X210 INFORMATION ETHICS L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To expose the issues of morality and technology at the Internet age.
- To give an idea on the development of computer ethics.
- To provide an overview ethics for the IT professional.
- To highlight the importance of computer crimes.
- To understand information security policy management.
- To aware the crime prevention, detection and response in internet.

**MODULE I OVERVIEW OF ETHICS 08**

Definition of Ethics, Importance of ethics ,the difference between Morals, Ethics and Laws – Ethics in the business world, fostering good business ethics Importance, Improving corporate ethics, Creating an ethical work environment, Ethical considerations in decision making – Ethics in information technology - IT professionals – IT users.

**MODULE II COMPUTER AND INTERNET CRIME 07**

IT security incidents: A major concern, Types of exploits, Types of perpetrators, Federal laws for prosecuting computer attacks – Implementing trustworthy computing, Risk assessment, Establishing a security policy, Educating employees and contract workers, Prevention, Detection and Response.

**L-15; TOTAL HOURS-15**

**REFERENCES :**

1. George W. Reynolds - “Ethics in Information Technology”, Fifth and Edition, Cengage Learning, ISBN: 1285197151, 2015.
2. Toni Samek and Lynette Shultz – “Information Ethics Globalization and Citizenship “McFarland & Company, ISBN: 9781476667720, 2017.

**OUTCOMES :**

Students who complete this course will be able to

- Identify the issues of morality and technology at the Internet age.
- Acquire the idea on the development of computer ethics.
- Illustrate the knowledge about the ethics of IT professional.
- Evaluate the security issues over internet.
- Identify security policy concerns in information management.
- Recognize the crime prevention, detection and response.

**SEMESTER V**

**Programme Elective ##2**

**Elective 1**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **CSC X101** | **2D CHARACTER ANIMATION** | **2** | **0** | **0** | **2** |

**OBJECTIVES :**

- To design a 2D character and create it through the tool.
- To develop characters inspired by humans, birds, fish, snakes and four legged animals.
- To provide each stage of the animation production process in an engaging visual style.
- To create and edit 2D animations using professional suite.
- To give knowledge on tools and basic functions to develop a character.
- To implement the animation using the adobe profession tool.

**MODULE I CONSTRUCTION OF CHARACTER 10**

Introduction to animation – Principles of animation - Matter and animation of inanimate objects –Inanimate objects - Construction of a simple character – Creating a character using Adobe illustrator.

**MODULE II ANIMATION 10**

Timing for animation -Animation of human walks and runs-Animation of animal walks and run- Animation and acting- Creating animation using Adobe Photoshop.

**MODULE III APPLICATIONS AND OUTCOMES 10**

Draw and cell animation – 3D stop motion animation – Animation for children – Digital animation – Creating comic book using adobe illustrator-Creating basic animation in Flash professionals.

**TOTAL HOURS-30**

**REFERENCES :**

1. Steve Roberts, "Character Animation Fundamentals: Developing skills for 2D and 3D character animation", Taylor & Francis publication, 2nd Edition, ISBN No: 9781136129490, 2012.
2. Debra Keller," Creating 2D Animation with the Adobe Creative Suite", Cengage Learning, 1st Edition, ISBN No: 9781133693482, 2013.

3. Paul Wells, Samantha Moore ," The Fundamentals of Animation", Bloomsbury Publishing, 2nd Edition, ISBN No: 9781474241786, 2017.

**OUTCOMES :**

Students who complete this course will be able to

- construct 2D character using step by step procedure.
- develop characters personality with chapter on acting, voice-synching and facial expressions.
- devise on timing on animation.
- use the animation tips, tricks and techniques for unique projects.
- compile a diverse portfolio of high-quality animations to showcase artistic talent and technical skill.
- expertise on creating animation of characters for different plays.

**CSC X102 IMAGE PROCESSING L T P C**

**2 0 2 3**

**OBJECTIVES :**

- To provide the basic foundation of image processing.
- To give knowledge on image formation and preprocessing.
- To function on feature extraction through different approaches.
- To explain the basic steps of segmentation process.
- To represent the image and processing on binary images.
- To implement the image processing techniques using tools.

**MODULE I FOUNDATION 07**

Components of Image processing system – Image Representation – Neighborhood operations – Multi scale Representation.

**MODULE II IMAGE FORMATION AND PREPROCESSING 08**

Quantitative Visualization – Image formation – Digitization, Sampling and Quantization.

**MODULE III FEATURE EXTRACTION 08**

Averaging – Box filter – Binomial filter - Edges – General properties of Edge filters – Gradient Based Edge Detection - Simple Neighborhood – Motion – Texture.

**MODULE IV IMAGE SEGMENTATION AND MODELING 07**

Segmentation – Pixel based, Edge based, Region based, Model based segmentations - Regularization and modeling – Unifying local analysis and global knowledge – Diffusion models – Network models – Inverse filtering.

**MODULE V IMAGE ANALYSIS 08**

Processing binary images- Correlation, Classification, Identification and Matching - Tomography- Methods for object measurement.

**MODULE VI PROGRAMMING 07**

Applications – Handling image files – Establishing image processing tools – Correcting and enhancing images - Programming with Open CV - Simple examples.

**L – 30; P – 30; TOTAL HOURS-60**

**REFERENCES :**

1. Bernd Jahne, ”Digital image processing”, Springer Science and Business Media,

5th Edition, ISBN: 978366204781, 2013.

2. John C Russ,"Image processing handbook", CRC Press, 7th Edition, ISBN: 9781498740289, 2016.
3. Gloria Bueno García et.al, "Learning Image Processing with OpenCV", Packt Publishing, 1st Edition, ISBN: 9781783287666, 2015.

**OUTCOMES :**

Students who complete this course will be able to

- Explain the basis of image processing techniques.
- Build image through methods and preprocess it.
- Extract the features of region of interest through filters.
- Segment the image using various segmentation techniques.
- Analyze the image and represent it through measurements.
- Represent image using Open CV.

**CSC X103 MULTIMEDIA APPLICATION DEVELOPMENT**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To summarize the fundamental concepts of multimedia.
- To learn the various paradigms in multimedia system.
- To identify the theoretical thoughts and practical knowledge of the multimedia development process.
- To incorporate and manipulate the multimedia building blocks.
- To expose on the different views of audio and video in multimedia applications.
- Use Action Script 3.0 to develop interactive applications in multimedia.

**MODULE I INTRODUCTION TO MULITMEDIA** **10**

Where to use Multimedia – Delivering Multimedia – Text in multimedia – Hypermedia and Hypertext – Image – Digital sound – Analog and digital video – Digital video containers.

**MODULE II INTERNET AND MULTIMEDIA** **10**

Internetworking - MIME Types - Multimedia on the web - Web servers and browsers - Web Page Makers and Site Builders - Plug-ins - Image, Sound, Video for the Web

**MODULE III APPLICATION DEVELOPMENT** **10**

Object oriented Features- Authoring an action script class - 2.0 Subclass - OOP Application Frame work, Components with ActionScript, MovieClip Subclasses.

**L – 30; TOTAL HOURS-30**

**REFERENCES :**

1. Tay Vaughan, "Multimedia Making It Work ", 8rd Edition, MC Graw Hill, 2011. ISBN: 978-0-07-174850-6
2. Nigel Chapman and Jenny Chapman, “Digital Multimedia”, 3rd Edition, Wiley Dreamtech, 2009. ISBN: 978-0-470-51216-6
3. Colin Moock, Essential ActionScript 3.0, 1st Edition, SPD O’Reilly, 2007. ISBN: 978-0-596-52694-8

**OUTCOMES :**

Students who complete this course will be able to

- Identify the components for building the multimedia blocks
- To effective use and produce the multimedia elements.

- Classify the function of the multimedia skill in the software industry.
- Choose an appropriate multimedia development mechanism for particular applications.
- Write a basic programs using Action Script language.
- Developing the application structure for the given real time scenario

**CSC X104** **3D ANIMATION** **L T P C**
**2 0 2 3**

**OBJECTIVES :**

- To introduce the fundamentals of 3D animations.
- To focus on the digital imaging and visualization techniques.
- To equip the student on the usage of 3D scanners and storage solutions.
- To provide understanding on the creation of stereoscopic 3D animations.
- To gather knowledge on the 3D programming based on WebGL and javascript.
- To learn the developing of a simple 3D application and 3D environment.

**MODULE I 3D ANIMATION OVERVIEW 8**

Exploring 3D animation, history of 3D animation, understanding the production pipeline's components, working in 3D animation preproduction, production, postproduction, usage of production tools.

**MODULE II DIGITAL IMAGING AND VIDEO 8**

Understanding digital imaging, understanding digital video, exploring animation, story, pre visualization, using principles of fine art and traditional animation, building a good story, using pre visualization techniques.

**MODULE III MODELLING AND ANIMATION 8**

Modeling and texturing, rigging and animation, creating visual effects, lighting, rendering, working with graphics tablets, using 3D scanners, setting up render farms, finding data storage solutions, choosing software.

**MODULE IV INDUSTRY TRENDS 5**

Using motion capture, creating stereoscopic 3D, integrating point cloud data, providing real time capabilities.

**MODULE V PROGRAMMING 3D APPLICATIONS 8**

3D graphics basics, WebGL; real time 3D rendering, example, javascript 3D engine, 3D animations using frames, Advanced page effects, using 3D transforms.

**MODULE VI APPLICATION DEVELOPMENT TECHNIQUES 8**

3D content pipeline, 3D engines and frameworks, webGL framework, vizi framework,

developing a simple 3D application, developing, previewing, integrating, developing 3D environment.

**L - 30; P – 30; TOTAL HOURS-60**

**REFERENCES :**

1. Andy Beane , “3D Animation Essentials”, John Wiley & Sons, ISBN 1118239059, 2012.
2. Tony Parisi, “Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages”, O'Reilly Media, Inc, ISBN 1449363954, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Determine the production tools suitable for applications
- Possess knowledge on the digital imaging and visualization techniques.
- Identify the storage solutions for animations
- Develop stereoscopic 3D animations
- Comprehend 3D programming levels based on WebGL and javascript..
- Implement the programming fundamentals of 3D application creation

**CSC X105 ADVANCED COMPUTER GRAPHICS L T P C**
**2 0 2 3**

**OBJECTIVES :**

- To use specific tools and software to produce a graphic product based on the principle of creative art.
- To make a graphic product based on the principle of creative art.
- To create graphic material using tools and software in line with the industrial norm.
- To introduce scene graphs in representing transformation hierarchies in articulated models.
- To processes of vertex blending, vertex skinning and keyframing in skeleton animation module.
- To explore forward and inverse kinematics solutions for animating a joint chain.

**MODULE I 2D & 3D CONCEPTS 8**

Two dimensional Geometric transformation - Two dimensional viewing -Line, Polygon, Curve and Text clipping algorithms- Three dimensional object representation-Polygons, Curved lines, Quadric Surfaces.

**MODULE II COLOR MODELS 7**

Color Models - RGB, YIQ, CMY, HSV - Animations - Conversation between HSV and RGB Models-HLS Color Model-Color Selection and Applications.

**MODULE III RENDERING 7**

Introduction to Shading models - Flat and Smooth shading - Adding texture to faces - Adding shadows of objects - Building a camera in a program - Creating shaded objects - Rendering texture - Drawing Shadows.

**MODULE IV SCENE GRAPHS 8**

Basic structure- Transformation hierarchy - Relative Transformations – Bounding Volume Hierarchy – Sample Implementation: Group node, Object Node, Camera Node.

**MODULE V SKELETAL ANIMATION 7**

Articulated Character Models – Vertex Blending – Skeleton and Skin – Vertex Skinning – Transformation Blending.

**MODULE VI KINEMATICS 8**

Robot Manipulators – Forward Kinematics – Linear and Angular Velocity – Inverse Kinematics- Circular alignment Algorithm-Mesh Representation - Spatial Partitioning.

**L - 30; P – 30; TOTAL HOURS-60**

**REFERENCES :**

1. Ramakrishnan mukundhan “Advanced Methods in Computer Graphics with examples in in OpenGL”,Springer Education, ISBN: 9781447123392,2012.
2. Donald Hearn, Pauline Baker, "Computer Graphics with OPENGL - C Version", Pearson Education, 4th Edition, 2010.
3. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics- Principles and practice", Pearson Education, 2nd Edition, ISBN: 0201848406, 2007.

**OUTCOMES :**

Students who complete this course will be able to

- Use surface and object modeling techniques to build 3D models.
- Learn the principles and commonly used paradigms and techniques of computer
- Develop a facility with the relevant mathematics of computer graphics
- Be able to write basic graphics application programs including animation .
- Identify the performance characteristics of advanced computer graphics pipeline.
- Be able to design programs to display graphic images to given specifications

| CSC X106 | MULTIMEDIA DESIGN PROGRAM | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES :**

- To recognize the basics of event based programming using Adobe Flash Work with the timeline
- To comprehend the standards of Flex by which applications can be deployed consistently on all major browsers, desktops, and devices with necessary skills to design rich forms that apply the use of data binding and validation.
- To gain knowledge on both client and server side scripting with Tween Animations
- To identify with the Adobe Integrated Runtime Create 3D Effects
- To build interactive software as part of a development team (including artists, animators, designers, producers and/or other programmers).
- To apply programming techniques essential to the construction of multimedia systems.

**MODULE I UNDERSTAND THE FLASH WORKSPACE** **07**

Open a Document and Playa Flash Movie- Create and Save a Flash Movie - Work with the timeline - Distribute a Flash Movie Application

**MODULE II DRAWING OBJECTS IN ADOBE FLASH** **08**

Use the Flash Drawing and Alignment Tools- Select Objects and Apply Colors -Work with Drawn Objects - Abik with Text and Text Objects - Work with layers and Objects

**MODULE III WORKING WITH SYMBOLS AND INTERACTIVITY** **09**

Create Symbols and Instances- Work with libraries - Create Buttons - Assign Actions to Frames and Buttons -Import Graphics

**MODULE IV CREATING ANIMATIONS** **07**

Create Motion Tween Animations- Create Classic tween animation - Create Frame-by-Frame Animations -Create Shape tween Animations - Create Movie- Animate Text

**MODULE V CREATING SPECIAL EFFECTS** **07**

Create A Mask Effect - Add Sound - Add Video - Create an Animated navigation Bar - Create Character Animations Using Inverse Kinematics - Create 3D Effects -Use the Deco Tool

**MODULE VI PREPARING AND PUBLISHING APPLICATIONS** **07**

Publish Movies Using Different formats – Reduce file Size to Optimize a Movie - Create a Preload& - Publish AIR Applications -Create and Publish Applications for Mobile Devices

**L – 30 ;P-30;TOTAL HOURS-60**

**REFERENCES :**


1. James Shuman,"Adobe Flash CS6 (Revealed)",Course Technology Ptr (Sd), ISBN : 978-1133693215,2012
2. Joseph Labrecque,"Learning Adobe Edge Animate", Packt Publishing,1st edition, ISBN: 1849692424, 2012
3. William Sanders,"Learning PHP Design Patterns", Shroff/O'Reilly; First edition, ISBN-10: 935110060X, ISBN-13: 978-9351100607, 2013.
4. Vic Costello,"Multimedia Foundations" Focal Press ,1st edition, ISBN-10: 0240813944, ISBN-13: 978-0240813943,2012


**OUTCOMES :**

Students who complete this course will be able to

- Evaluate and apply classes from a multimedia application programmer interface (API) or framework to aid the development of multimedia systems.
- Evaluate and apply appropriate methods for the storage, delivery and display of multimedia data.
- Develop object oriented programs to manipulate media objects.
- Apply programming techniques essential to the construction of multimedia systems.
- Implement effective design, production and testing techniques (including appropriate project engineering and management) through all phases of game development as relevant to programmers/engineers
- Communicate effectively (through the use of written material and visual presentations) to both technical and non-technical game developers.

**CSC X107** **NETWORK MODELING** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To empathize the basic concepts of lower and higher layer wireless modeling.
- To discuss about graphical models for different routing protocols.
- To expose user behavior in P2P systems and analyze the security aspects of network data in the Internet.
- To provide an overview on different network simulators for wireless network.
- To gain knowledge on different open source network simulators.
- To examine the performance of the network using simulation tools.

**MODULE I** **LOWER LAYER WIRELESS MODELING** **09**

Physical Layer Modeling - Link Layer Modeling - Channel Modeling - Selected System Models - Wireless Networking Use Cases - Modeling Mobility - Modeling Handover from the Access Networks' Perspective.

**MODULE II** **HIGHER LAYER WIRELESS MODELING -I** **07**

Modeling the Network Layer and Routing Protocols - Modeling Transport Layer Protocols - Modeling Application Traffic.

**MODULE III** **HIGHER LAYER WIRELESS MODELING -II** **06**

Modeling the Internet Delay Space and its application in Large Scale P2P Simulations - . Modeling User Behavior in P2P Systems - Modeling Security Aspects of Network - Modeling the Network Topology.

**MODULE IV** **COMPUTER NETWORK PERFORMANCE MODELING AND SIMULATION** **08**

Performance Modeling – Performance metrics in computer network simulation – Discrete event Simulation – Validation and Verification – Network Simulators – Case study on different Network Simulators.

**MODULE V** **MODELING APPROACHES OF COMPUTER NETWORKS AND SYSTEMS** **08**

On the self-similarity of traffic generated by network traffic simulators – Hurst Parameters – Analysis – Performance evaluation and Petri nets – Markov Chain models and applications.

**MODULE VI** **SIMULATION METHODOLOGIES IN COMPUTER NETWORKS AND SYSTEMS** **07**

A model- driven method for the design time performance analysis of Service-oriented Software systems – Model driven architecture and Method – Current and future trends in Open Source network simulators for wireless systems.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**


1. Klaus Wehrle, Mesut Gunes, James Gross, “Modeling and Tools for Network Simulation”, Springer-Verlag Berlin Heidelberg, ISBN: 978-3-642-12331-3, 2016.
2. Mohammad S. Obaidat , Faouzi Zarai , Petros Nicopolitidis, “Modeling and Simulation of Computer Networks and Systems: Methodologies and Applications, Morgan Kaufmann; 1st edition , ISBN-13: 978-0128008874, 2015.
3. Mohsen Guizani and Ammar Rayes, “Network Modeling and Simulation: A Practical Perspective”, Wiley-Interscience; 1 edition, ISBN-13: 978-0470035870, 2010.
4. Jack L. Burbank , William Kasch , Jon Ward , “An Introduction to Network Modeling and Simulation for the Practicing Engineer”, 1st Edition,Wiley-IEEE Press; 1 edition, ISBN-13: 978-0470467268, 2011.


**OUTCOMES :**

Students who complete this course will be able to

- Categorize the suitable network models for different network layer characteristics.
- Design different graph models and examine challenges in designing it.
- Create network model for P2P systems and analyze its security using network simulators.
- Relate the QoS of the network using the inference and prediction analysis.
- Explore the existing modeling approaches of computer networks and systems.
- Analyze the need of Open Source network simulators for wireless systems.

**CSC X108 CELLULAR AND WIRELESS NETWORKS L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To learn about the challenges and opportunities with respect to cellular networks.
- To provide a knowledge on capacity and coverage analysis of relay node.
- To explain the concepts for improving the performance of cellular networks.
- To describe the evolution of wireless networks standards such as IEEE 802.16, blue tooth and 3G.
- To expose the students to have a knowledge on UMTS.
- To illustrate the wireless standards such as CDMA 2000 & WiMax.

**MODULE I CELLULAR NETWORKS CHALLENGES AND OPPORTUNITIES 07**

Introduction – LTE – A – Cooperative relaying – Concept of Relay Node - Relay classification – Relay Node – RN enhance cellular Network – RN mode operation in LTE-A – RN planning in cellular network – Moving Relay .

**MODULE II CAPACITY AND COVERAGE ANALYSIS FOR MULTI HOP RELAY 07**

Introduction – Channel interference – Network capacity without RN – Handover process analysis - Network capacity with RN – Optimum RN location – Optimum number of relays – Pseudo code of RN deployment – Frequency reuse for multi hop relay – Enhance relay link capacity – System modeling – Balance transmission power for MR.

**MODULE III PERFORMANCE ENHANCEMENT OF COVERAGE AREA AND CAPACITY 07**

Mitigating interference between RNs – Relay link enhancement – UL and DL performance analysis.

**MODULE IV INTRODUCTION TO WIRELESS NETWORKS 08**

Evolution of mobile communications – fundamentals – mobile data – WiFi – Bluetooth – Cable systems – Wireless migration options – Harmonization process – Overview of 3G networks.

**MODULE V UNIVERSAL MOBILE TELECOMMUNICATION SERVICES (UMTS) 08**

Introduction – UMTS basics – WCDMA air interface – UTRAN architecture – Establishment of UMTS Speech Call – UMTS packet data – High Speed Packet data –

Handover – HSPA connection establishment.

**MODULE VI CDMA 2000 and WiMax 08**

Radio and network components – Network structure – Packet Data transport process flow – Radio network – WiMax standards – Generic WiMax Architecture – Core Network – Radio Network – Wimax spectrum – Modulation – Channel Structure – Applications.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Clint Smith, Daniel Collins, “Wireless Networks”, McGrawHill Education, 3rd edition, ISBN-10: 9339218159, ISBN-13: 978-9339218157, 2014.
2. Abid Yahya , “LTE-A Cellular Networks: Multi-hop Relay for Coverage, Capacity and Performance Enhancement”, Springer, ISBN : 3319433040, 2016.
3. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, ISBN 10: 0124051626 ISBN 13: 9780124051621, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Specify the opportunities and challenges with cellular networks.
- Analyze the capacity and coverage problem with multi hop relay
- Assess the performance enhancement of coverage area and capacity.
- Acquire knowledge on wireless communication standards like WiFi, Bluetooth and 3G networks.
- Illustrate the working principles of wireless UTMS.
- Have exposure to CDMA 2000 and WiMax architecture.

**CSC X109 NETWORK MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To acquire knowledge on networking and networking technologies.
- To explore difference between SNMP V1,V2 and V3.
- To study about remote monitoring and its application.
- To discuss the basic terminologies and application of telecommunication management system.
- To expose the application of network management
- To examine the importance of broadband Networks.

**MODULE I BASIC TERMINOLOGIES 07**

Network Management Goals, organization and Functions, Network Management Architecture and organization, Network Management Perspective, NMS platform, Current Status and future of Network Management.

**MODULE II SIMPLE NETWROK MANAGEMENT PROTOCOL V1,V2,V3 12**

SNMP V1 Network Management, Basic Foundation Standards, Models and languages, Organization and information Models, Communication and functional Models.

SNMP V2 - Changes , System Architecture, Structure of Management Information, MIB, Protocol, Compatibility. SNMP V3 – Key Features, Architecture, Application, MIB, Security.

**MODULE III REMOTE MONITORING 05**

RMON SBI MIB, RMON1, RMON2, ATM ROM, Case Study.

**MODULE IV TELECOMMUNICATION MANAGEMENT 05**

TMN conceptual Model, Standards, Architecture, Management Service Architecture, integrated View, Implementation

**MODULE V NETWORK MANAGEMENT APPLICATION 08**

Network Management Application –Configuration Management, Fault Management, Performance Management, Event Correlation techniques, Security Management.

**MODULE VI BROADBAND NETWORKS MANAGEMENT 08**

ATM Technology, ATM Network Management, Wireless Access Network, Basic

Principles, Fixed Broadband Wireless access networks, Mobile Wireless Networks, Satellite Networks, Broadband Home Networks.

**L – 30; TOTAL HOURS-30**

**REFERENCES :**

1. Mani Subramanian “Network Management : Principles and Practice Pearson Edition “2nd edition, ISBN : 978-8131734049, 2010.
2. Adrian Farrel ,”Network Management –Know it all”, Morgan Kaufmann Publishers, 1st Edition ISBN : 9780080923420, 2008.

**OUTCOMES :**

Students who complete this course will be able to

- Acquire the knowledge about the basic terminologies of network management.
- Illustrate the standards and models of SNMP V1.,V2 & V3.
- Analyze the challenges faced by remote monitoring and suggest suitable solutions.
- Recommend telecommunication management network standards for real time scenarios.
- Evaluate the various applications of network management system.
- Compare and contrast the different broadband network strategies.

**CSC X110 NETWORK SIMULATORS**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To illustrate the need for network simulators.
- To study the network simulator tools for analyzing the performance of computer networks.
- To test the performance of any one of the wired, wireless network routing protocol using the network simulator.

**MODULE I NS3 and OMNET++5.1 09**

Downloading – Installing - Building – Testing – Tweaking: using Logging Module, Command Line Arguments, Tracing System – Building Topologies – Tracing – Data Collection.

**MODULE II NETWORK PERFORMANCE ANALYSIS 06**

Case Study : Analyze the performance of wired or wireless network routing protocol in terms of QoS parameters.

**L-15;TOTAL HOURS- 15**

**REFERENCES :**

1. https://omnetpp.org/, https://www.nsnam.org
2. Thomas Bonald, Mathieu Feuillet, “Network Performance Analysis”, John Wiley & Sons, ISBN :1118602854, 9781118602850, 2013.
3. Matthew N.O. Sadiku, Sarhan M. Musa, “ Performance Analysis of Computer Networks”, Springer Science & Business Media, ISBN : 3319016466, 9783319016467, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Do modifications in the existing routing protocol depending upon the requirement.
- Illustrate the performance of wired and wireless networks.
- Implement and analyze the performance of network routing protocols.

**CSC X111** **AGILE PRACTICES** **L T P C**
**1 0 0 1**

**OBJECTIVES :**

- To critically think in adapting a software engineering methodology.
- To understand the practices and philosophies of agile methods.
- To enable the students to plan and complete projects and understand stakeholders.
- To adapt to agile practices and approaches.
- To be conversant with Agile project management and its best practices.
- To explore tools for agile project management.

**MODULE I AGILE METHODOLOGY AND PRACTICES 07**

Agile Development – Agile Manifesto – Phases- Planning- Scaling-Roles –Agile Communications and tools. Impact of different business environments on Agile – Different Agile approaches- Scrum-Extreme Programming-Lean- Kanban

**MODULE II AGILE PRACTICES 08**

Agile Software Development Practices -Code refactoring - Continuous integration Pair Programming Test-driven development Extreme programming (XP) - Agile Quality Management Practices- Key differences in agile quality management practices

**L-15; TOTAL HOURS- 15**

**REFERENCES :**

1. Charles G.Cobb,"The Project Manager's Guide to Mastering Agile: Principles and Practices for an Adaptive Approach", Wiley, ISBN: 978-1-118-99104-6.,2015.
2. Scott W.Ambler ,Matthew Holitza, "Agile for Dummies", John Wiley & Sons, ISBN: 978-1-118-30506-5,2012
3. Clyde Bank Business "Agile Project Management: Quick Start Guide - The Simplified Beginners Guide To Agile Project Management ", Clyde Bank Media LLC, ASIN: B00NF8H2FK, 2014.
4. Manifesto for Agile Software Development, http://www.agilemanifesto.org

**OUTCOMES :**

Students who complete this course will be able to

- Compare agile software development to traditional software development

models.

- Identify the benefits and pitfalls of transition to agile.
- Describe agile software development methodologies and approaches.
- Apply critical thinking in evaluating the options and tradeoffs implicit in selecting an appropriate software engineering methodology, with a focus on agile methods.
- Apply agile practices and principles to software development.
- Construct tailored agile processes that best fit the technical and market demands of a modern software project.

**CSC X112** **SOFTWARE TESTING** **L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To learn the testers role in a Software Development Organization.
- To find defects created by the programmer while developing the software.
- To portray the recent trends in the field of Software testing.
- To explore the different levels and types of testing.
- To have a thorough overview about the test design strategy and review plans.
- To throw light on the importance of test automation.

**MODULE I TESTING 10**

Test Principles – Testing Team – Skills of Tester – Types of Testing – Evaluating Test Cases – Reducing Test Case – Effective Testing – Economics – Structural Testing – Integration Testing – Functional Testing.

**MODULE II DEBUGGING 10**

Bugs, Faults, Failures – Verification and Validation - Defect Management - Types of Defects – Cost of fixing Defects – Handling Defects – Risks – Traceability Matrix – Test Management – Cloud Testing.

**MODULE III TEST AUTOMATION 10**

Automation Testing – Activities – Frameworks – Automation Tools – Types – Scripting Language – Testing Specialized Systems.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Anirban BASU, “Software Quality Assurance, Testing And Metrics”, Pearson Hall India, ISBN: 978-81-203-5068-7, 2015.
2. Sandeep Desai , Abhishek Srivastava, “Software Testing : A Practical Approach”, Second Edition, Pearson Hall India, ISBN: 978-81-203-5226-1, 2015.
3. William E. Perry, " Effective Methods for Software Testing", Wiley Publications, Third Edition, ISBN 978-0-7645-9837-1, 2007

**OUTCOMES :**

Students who complete this course will be able to

- Apply the appropriate testing technique for the developed software.
- Choose various testing design strategies needed for the software application.
- Perform different types of testing given an application.
- List the type of defects in a software application.
- Utilize various software testing tools and automation techniques.
- Test software in a structured and organized way.

**CSC X113 SOFTWARE REQUIREMENTS AND MODELLING**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To introduce the concepts and the role of requirements engineering in software engineering.
- To introduce the different requirements elicitation techniques
- To describe the processes of requirements elicitation and analysis techniques.
- To consider the rationale in defining requirements and preparing requirements analysis documents.
- To provide an insight in to the current techniques, notations, methods, processes and tools used in requirements engineering.
- To provide comprehensive knowledge about the different tools for requirements management.

**MODULE I SOFTWARE REQUIREMNTS 10**

Essential Software Requirement – Requirements from Customers Perspective – Good Practices – Business Analyst.

**MODULE II REQUIREMENTS DEVELOPMENT 10**

Establishing Business Requirement – Requirements Elicitation – Understanding User Requirements – Documenting Requirements – Writing Excellent Requirements – Validating Requirements – Requirement Reuse.

**MODULE III FOR REQUIREMENT MANAGEMENT 10**

Requirements Management Practices – Change Control – Links in Requirements Chain –Tools for Requirements Engineering - Improving Requirement Processes – Risk Management.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Karl Wegers & Joy Beatty," Software Requirements", 3rd Edition, Microsoft Press, ISBN-978-0735679665, 2013.
2. Swapna Kishore & Rajesh Naik, "Software Requirements and Estimation", Tata McGrawHill, ISBN-978-007-040312-3,2008.
3. Ian Sommerville and P Sawyer, "Requirements Engineering a Good Practice Guide", 1st Edition, Wiley India, ISBN: 978-0-471-97444-4,1997.
4. Leffingwell, D.Widrig, D, "Managing Software Requirements A Use Case

Approach", 2nd Edition, Pearson Education, ISBN: 9780201615937, 2000.

**OUTCOMES :**

Students who complete this course will be able to

- Analyze the various requirements elicitation methods and select the appropriate one.
- Identify the requirements of a project and document requirements.
- Reuse the requirements for effective utilization of time and cost.
- Explore requirement analysis methods and traceability of requirements
- Demonstrate the notational paradigms that can be applied to requirements.
- Apply methods and tools for requirements management from the development of project

**CSC X114 THEORY OF COMPUTATION L T P C**

**3 0 0 3**

**OBJECTIVES :**

- Identify the type of problems that can be solved using computation
- Describe the models through which computation can be expressed.
- Enhance students' ability to conduct mathematical proofs for computation.
- Demonstrate the key notions, such as algorithm, computability, decidability, and complexity through problem solving.
- Describe the challenges of theoretical computer science and its contribution to other sciences.
- Exemplify the features of a turing machine and identify its suitability for the given task.

**MODULE I INTRODUCTION 07**

Why study Automata Theory- Introduction to Formal Proof - Additional Forms of Proof Inductive Proofs- The Central Concepts of Automata Theory

**MODULE II REGULAR EXPRESSIONS 09**

An Informal Picture of Finite Automata- Deterministic Finite Automata-Nondeterministic Finite Automata- Finite Automata With Epsilon Transitions-Equivalence and Minimization of Automata.

**MODULE III REGULAR EXPRESSIONS 08**

Regular Expressions- Finite Automata and Regular Expressions-Pumping Lemma of regular languages- Properties of regular languages.

**MODULE IV CONTEXT-FREE GRAMMARS AND LANGUAGES 08**

Context-Free Grammars- Parse Trees- Ambiguity in Grammars and Languages- Normal Forms of Context Free Grammars- Pumping Lemma of Context Free Languages.

**MODULE V PUSH DOWN AUTOMATA 07**

Definition of the Pushdown Automaton - The Languages of a PDA Equivalence of PDA's and CFG's- Deterministic Pushdown Automata

**MODULE VI TURING MACHINES 06**

The Turing Machine- Programming Techniques for Turing Machines- Extensions to the Basic Turing Machine- Turing Machines and Computers.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. John Hopcroft, Rajeev Motwani & Jeffry Ullman "Introduction to Automata Theory, Languages & Computation", 3rd Edition, Pearson Education, 2012, ISBN : 978-0201029888.
2. John C Martin, "Introduction to Languages and Automata Theory", 3rd Reprint Edition, Tata McGraw-Hill, 2008. ISBN: 978-1118014783.
3. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, PWS Publishing Company, 2013. ISBN: 978-1133187790.

**OUTCOMES :**

Students who complete this course will be able to

- Apply mathematical proof to real time computation problem.
- Solve simple problems in RE's, DFA's, NFA's, Turing machines and Grammars.
- Prove/disprove the basic results of the Theory of Computation.
- Describe the Grammars of Context Free Languages.
- Analyze the core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.
- Knowledge of recent technologies to enable them to face the world.

**CSC X115 INTERNET OF THINGS**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- Comprehend the design concepts and principles of IoT
- Understand the role of electronics and embedded computing in IoT
- Interpret the limitations and opportunities of wireless and mobile networks for Internet of Things
- Attain exposure to varied software and hardware platforms for realization of IoT
- Determine applications of IoT in various fields
- Analyze trade-offs in interconnected wireless embedded sensor networks or IoT

**MODULE I IoT FUNDAMENTALS AND APPLICATIONS 10**

Definitions – IoT communications Model – Device to Device communications- Device to Cloud communications – Device to Gateway Model – Back-End Data Sharing Model- Issues in ToT - Technological Aspects - Design Principles of Connected Devices – IPv6 concepts – IPV6 packet – IPV6 addressing- Addressing and Protocols relevant to IoT – Applications - Smart Cities and Environments – Smart Metering – Applications in Security – Healthcare – Retail – Industrial Control –Smart Farming and Agriculture.

**MODULE II IoT PROTOTYPING CONCEPTS AND PHYSICAL DESIGN 10**

Prototyping and Production – Open Source vs Closed Source – Electronics and Embedded Computing Fundamentals : Sensors - Actuators - Microcontrollers – System on Chips – Platform considerations- Physical Design - Sketch- Iterate-Explore – Non-Digital Methods- Laser Cutting – 3D Printing – CNC Milling – Repurposing and Recycling.

**MODULE III IoT TECHNOLOGY PLATFORMS AND SOFTWARE DESIGN PRINCIPLES 10**

Raspberry Pi – Raspbian - Arduino – Case Studies: Healthcare, Smart Cities, Analytics- IoT Connectivity Considerations – IoT and Cloud Access - REST – MQTT – CoAP – XMPP IOT.

**TOTAL HOURS-30**

**REFERENCES :**

1. Adrian McEwen and Hakim Cassimally , “Designing the Internet of Things”,

Wiley, ISBN-13: 978-1118430620, 2013.
2. Cuno Pfister, "Getting Started with the Internet of Things",1st Edition, Shroff, ISBN-13: 978-1449393571,O'REILLY, 2011.
3. Donlad Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", McGraw-Hill Education - Europe, ISBN10 0071835202, 2015

**OUTCOMES :**

Students who complete this course will be able to

- Describe the IoT concepts and design principles in detail.
- Analyze the different devices, components, antenna and standards are available in IoT.
- Explore the design of simple IoT devices for different application domains
- Compare and choose appropriate software and hardware platform for realization of IoT devices
- Apply the IoT concepts in real time applications using the IoT devices
- Identify the security issues faced by IoT in various areas.

**CSC X116 COGNITIVE SCIENCE L T P C**

**2 0 0 2**

**OBJECTIVES :**

- Introduce the domain of cognitive science
- Present the different methods of representation of thought
- Outline mind as an information processor
- Categorize the models of attention
- Expose case studies in mind representation
- Relate language with cognitive science

**MODULE I MIND AND PHILOSOPHY 09**

Definition – Representation types – Computation – Tri-level hypothesis – Classical and connectionist views of computation – Various Approaches to Cognitive science - Reasoning - Philosophy – Mind body problem – Knowledge acquisition problem

**MODULE II VISION AND ATTENTION 09**

Mind as an Information Processor -Modularity of Mind - Theories of Vision and Pattern Recognition - Feature Detection Theory - Theories of Attention - Models of Attention

**MODULE III MIND, LANGUAGE AND COGNITION SCIENCE 12**

The Network Perspective - Semantic Networks: Meaning in the Web - Overall Evaluation of the Network Approach - The Linguistic Approach: The Importance of Language - Nature of Language - Language Use in Primates - Language Acquisition - Philosophy and Linguistics: The Linguistic - Neuroscience and Linguistics - Artificial Intelligence and Linguistics.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Jay Friedenberg and Gordon Silverman, “Cognitive Science: An Introduction to the study of the Mind”, Sage Publishers, Third Edition - ISBN-13: 978-1483347417, October 2015.
2. Bernard J. Baars and Nicole M. Gage, Cognition, Brain, And Consciousness Introduction to Cognitive Neuroscience, Second Edition, Elsevier Publication, 2010, ISBN :978-0-12-375070-9.

**OUTCOMES :**

Students who complete this course will be able to

- Define cognitive science and relate its various disciplines
- Illustrate thinking as a computational problem
- Model the way mind works as an information processor
- Demonstrate the theories and models of attention
- Illustrate the way in which knowledge is represented
- Showcase the evolution of language in humans and describe how artificial intelligence approaches can work

**CSC X117 VIRTUALIZATION TECHNIQUES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To lay down the foundation of virtualization and its importance.
- To learn the essentials required to build virtualization.
- To provide an overview of the taxonomy of virtualization.
- To identify security implications in virtualization
- To expose the students to create and manage the virtual machine.
- To comprehend the technical capabilities and business benefits of virtualization.

**MODULE I OVERVIEW OF VIRTUALIZATION 08**

Describing Virtualization - Moore's Law - Importance of Virtualization –Types - Current Trends - Virtualization and Cloud Computing - Virtualization Software Operation - Virtualizing Servers - Virtualizing Desktops - Virtualizing Applications - Hypervisor - Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor - Resource Allocation - Current Hypervisors - VMware ESX - Microsoft Hyper V

**MODULE II INTRODUCTION TO VIRTUAL MACHINES 07**

Virtual Machine - Examining CPUs in a Virtual Machine - Examining Memory in a Virtual Machine - Examining Network Resources in a Virtual Machine - Examining Storage in a Virtual Machine - Working with Virtual Machines - Virtual Machine Clones - Templates - Snapshots - Containers.

**MODULE III VIRTUAL MACHINE CREATION 07**

Performing P2V Conversions - Investigating the Physical-to-Virtual Process - Hot and Cold Cloning - Loading the Environment - VMware Workstation Player - Loading VirtualBox - Building a new Virtual Machine.

**MODULE IV MANAGING CPU AND MEMORY FOR VIRTUAL MACHINE 07**

CPU Virtualization - Configuring VM CPU Options - Tuning Practices for VM CPUs - Choosing Multiple CPUs - Hyper-Threading - Memory Virtualization - Configuring VM Memory Options - Tuning Practices for VM Memory - Calculating Memory Overhead - Memory Optimizations.

**MODULE V MANAGING STORAGE AND NETWORKING FOR A VIRTUAL MACHINE** **08**

Storage Virtualization – Configuring VM Storage Options - Tuning Practices for VM Storage - Network Virtualization - Configuring VM Network Options - Tuning Practices for Virtual Networks - Deploying Applications in a Virtual Environment

**MODULE VI VIRTUALIZATION SECURITY** **08**

Fundamentals of Virtualization Security - Securing Hypervisors - Designing Virtual Networks for Security - Architecture Considerations.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Matthew Portnoy, “Virtualization Essentials”, Wiley, Second edition, ISBN : 9788126564668, 2016
2. Daniel Kusnetzky, "Virtualization: A Manager's Guide", O'Reilly Media, Illustrated, 9781449306458 2012.
3. Tom White, “Hadoop: The Definitive Guide Storage and Analysis at Internet Scale” O'Reilly Media Press, ISBN : 9781449311520, 2012.
4. Dave Shackleford, “ Virtualization security- Protecting Virtualized Environments”, Sybex Publishers, First Edition, ISBN : 978118288122, 2012.

**OUTCOMES :**

Students who complete this course will be able to

- Review virtualization concepts and their role in elastic computing.
- Articulate the main concepts, key technologies, strengths, and limitations of Virtualization.
- Analyze different types of virtualization with performance metrics.
- Describe the architecture and taxonomy of virtualization.
- Analyze the constraints and techniques in setting up virtualization through its enabling technologies.
- Design virtualization infrastructure solutions and give recommendations based on the need.

**Elective 2**

| CSC X122 | FOUNDATION ON ROBOTICS | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES :**

- To have an exposure on the basics of robotics concept.
- To gain knowledge about industrial robotics and classification.
- To study the protocols and functions related to robotics.
- To enhance students' understanding of operational capabilities and specifications.
- To learn the robot programming methods and its applications.
- To know the mechanisms of sensors and actuators.

**MODULE I FUNDAMENTALS OF ROBOTICS 10**

Overview of robotics, industrial robot, classification, Degree of freedom , degree of motion, robot components, joints and symbols, robot configuration, economic and social issues.

**MODULE II ROBOT PROGRAMMING AND MODULAR COMPONENTS 10**

Robot programming methods, advantages and disadvantages of robot, specifications, operational capabilities level, modular robot components.

**MODULE III ROBOT SENSORS AND ACTUATORS 10**

Internal and external sensors, static and dynamic performance characteristics, types of actuators, examples.

**L-30;TOTAL HOURS-30**

**REFERENCES :**

1. Appu k.kutta, "Robotics", I. K. International Pvt Ltd, ISBN: 9788189866389, 2010.
2. Tsuneo Yoshikawa, "Foundations of Robotics: Analysis and Control", MIT Press, 2nd edition, ISBN: 0262240289, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Address the degrees of freedom for objects
- Describe the requirements and mechanisms for types of robotics.

- Determine robot programming methods for various applications.
- Examine the mechanisms of sensors and actuators with examples.
- Have deeper knowledge on operational capabilities and specifications.
- Comprehend different protocol architectures and functions used in robotics.

**CSC X123 SOUND EDITING AND PROCESSING L T P C**

**2 0 2 3**

**OBJECTIVES :**

- To gain knowledge about existing supporting technologies for sound and editing
- To learn about various speech and audio technologies
- To identify the basic concepts of digital audio and speech
- To gain knowledge about speech analysis and classification
- To gain of the scientific principles relevant to the generation and propagation of musical sound, including the functioning of musical instruments
- To recognize audio signal processing and Parameterization

**MODULE I INTRODUCTION TO SOUND AND SPEECH 07**

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

**MODULE II BASIC AUDIO PROCESSING 08**

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

**MODULE III THE HUMAN VOICE 09**

Speech production-Characteristics of speech-Types of speech-Speech understanding

**MODULE IV THE HUMAN AUDITORY SYSTEM 07**

Physical processes -Perception -Amplitude and frequency models

**MODULE V PSYCHOACOUSTICS 07**

Psychoacoustic processing-Auditory scene analysis -Psychoacoustic modeling - Hermansky-style model-MFCC model-Masking effect of speech

**MODULE VI SPEECH COMMUNICATIONS 07**

Quantization - Parameterization -Pitch models - Analysis-by-synthesis-Perceptual weighting

**L – 30; P-30;TOTAL HOURS-60**

**REFERENCES :**

1. Ian Vince McLoughlin “Speech and Audio Processing: A MATLAB-based

Approach ", Cambridge University Press, ISBN: 1107085462, 2016.
2. David Miles Huber , Robert E. Runstein"Modern Recording Techniques (Audio Engineering Society Presents) , Focal Press; 8 edition, ISBN-10: 0240821572, ISBN-13: 978-0240821573, 2013
3. Michael Talbot-Smith "Sound Engineering Explained", Focal Press; 2 edition, ISBN: 0240516672, 2012

**OUTCOMES :**

Students who complete this course will be able to

- Apply the basics of audio theory and musical acoustics to real world recording situations
- Proficiently operate and interpret specifications of audio recording and live sound equipment.
- Produce audio recordings by using digital audio workstations (Avid Pro Tools, Cockos, Reaper, etc.
- Run sound at live events. Show proficiency in music production techniques for genres such as Classical, Jazz and Rock
- Demonstrate basic video recording and editing skills to facilitate additional opportunities in the broader digital media field. Read and perform music at an intermediate level
- Write and speak effectively about music.

**CSC X124** **COMPUTER VISION** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- Describes the foundation of image mating, composting and editing
- Understand the camera parameters and calibration
- Grasp the principles of match moving and motion capture
- Develop the practical skills necessary to build computer vision applications.
- Provides knowledge on three dimensional data acquisition
- Showcase the different Methods of three dimensional Computer Vision

**MODULE I INTRODUCTION AND IMAGE MATTING 08**

Introduction – Computer Vision for Visual Effects – Matting Terminology – Blue-Screen, Green-Screen and Difference Matting – Bayesian Matting – Closed-Form Matting – Markov Random Fields for Matting – Random-Walk Methods – Poisson Matting – Hard-Segmentation-Based Matting – Video Matting – Matting Extensions

**MODULE II IMAGE COMPOSITION AND EDITING ,FEATURES AND MATCHING 08**

Compositing Hard-Edged Pieces – Poisson Image Editing – Graph-Cut Compositing – Image Inpainting –Image Retargeting and Recompositing - Video Recompositing, Inpainting, and Retargeting - Feature Detectors – Feature Descriptors – Evaluating Detectors and Descriptors – Color Detectors and Descriptors – Artificial Markers

**MODULE III MATCHMOVING AND MOTION CAPTURE 08**

Feature Tracking for Matchmoving – Camera Parameters and Image Formation – Single Camera Calibration- Extension of Matchmoving - Environment – Marker Acquisition and Cleanup – Forward Kinematics and Pose Parameterization – Inverse Kinematics – Motion Editing – Facial Motion Capture – Markless Motion Capture

**MODULE IV THREE-DIMENSIONAL DATA ACQUISITION 07**

Light Detection and Ranging (LiDAR) – Structured Light Scanning – Multi-View Stereo – Registering 3D Datasets

**MODULE V METHODS OF 3D COMPUTER VISION 07**

Triangulation-Based Approaches to Three Dimensional Scene Reconstruction – Three

Dimensional Pose Estimation and Segmentation Methods

**MODULE VI INTENSITY BASED AND POLARISATION BASED APPROACHES TO 3D SCENE RECONSTRUCTION** **07**

Intensity based and polarisation based approaches to 3d scene reconstruction - Shape from Shadow – Shape from Shading – Photometric Stereo – Shape from Polarisation – Point Spread Function Based Approaches to 3D Scene Reconstruction – The Point Spread Function – Reconstruction of Depth from Defocus –Reconstruction of Depth from Focus

**L-45;TOTAL HOURS-45**

**REFERENCES :**


1. Richard J Radke, “Computer Vision for Visual effects”, First Edition, Cambridge University Press, ISBN:978-0-521-76687-6, 2013.
2. Christian Wohler, “3D Computer Vision”, Second Edition, Springer – ISBN:9781-4471-4149-5 , 2013.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, ISBN: 978-0-123-96549-3, 2012.
4. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer, ISBN: 978-1-84882-934-3, 2011.
5. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, MIT Press, ISBN: 978-0-262-02818-9, 2014.
6. Amar Mitiche, J.K. Aggarwal,”Computer Vision Analysis of Image Motion by Variational Methods”, ISBN: 978-3-319-00711-3, 2013.
7. Christian Woohler,”3D Computer Vision: Efficient Methods and Applications”, Second Edition, Springer, ISBN: 978-1-4471-4150-1, 2013.


**OUTCOMES :**

Students who complete this course will be able to

- Familiar theoretical aspects of computing with images;
- Differentiate the mage, video Retargeting and Recompositing
- Analyze the camera parameters and form the image
- Gaining exposure to three dimensional data acquisition
- Construct 3D stereo and video images.
- Apply the 3D models in different applications

| CSC X125 | MOBILE MULTIMEDIA SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To summarize the basic concept of multimedia system
- To learn the various paradigms in mobile cellular networks.
- To identify the security issues in multimedia system
- To incorporate the user needs in cellular system
- To expose the structure of the mobile networks using multiple input and output system.
- To enable the principles and trade-offs involved in the design of mobile networks.

**MODULE I INTRODUCTION TO MOBILE MULITMEDIA** **10**

Where to use Mobile Multimedia – Multimedia over wireless Mobile data networks – Quality of Service issues – Speech and Video Coding.

**MODULE II MOBILE CELLULAR SYSTEM** **10**

Narrowband cellular systems – Wideband systems: CDMA, OFDM, Multiuser capacity and opportunistic communication – MIMO I - MIMO II MIMO III and MIMO IV: multiuser communication.

**MODULE III MOBILE SECURITY AND SERVICES** **10**

Security and privacy issues – Trust for mobile computing applications – Design challenges for Multimedia networks – QoS and QoE of cellular networks.

**TOTAL HOURS-30**

**REFERENCES :**

1. Gaur Karmakar, and Laurence S Dooley, “Mobile Multimedia Communications: Concepts, Applications, and Challenges”, IGI Global, 2008, ISBN: 9781591407683.
2. Yan Zhang, Shiwen Mao, Laurence T. Yang, and Thomas M Chen, “Broadband Mobile Multimedia: Techniques and Applications”, CRC Press, 2008. ISBN: 978-1-4200-5184-1
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2010 ISBN:978-0-521-84527-4

**OUTCOMES :**

Students who complete this course will be able to

- Identify the Mobile networks with QoS services
- To effective use and produce the mobile networks.
- Classify the function of the various cellular systems.
- To implement and analyses the different networks and compare their performances.
- Enriched with the knowledge of recent day techniques to enable them in the real world.
- Developing the application structure of mobile system for the given real time scenario

**CSC X127 ONLINE VIDEO PRODUCTION**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To introduce the fundamentals of video production.
- To focus on the production methods and techniques.
- To equip the student on script writing and camera features.
- To provide understanding on the audio and lighting for video.
- To know about television graphics and video recording.
- To have a deeper knowledge on the online video distribution.

**MODULE I VIDEO PRODUCTION BASICS** **07**

Video production overview, Production crew, organizing the production, production process, production methods, empirical approach, planned approach, stages of production, production techniques - Outline script, basic script formats, suggestions on script writing, directing, camera features, controlling and using the camera.

**MODULE II DISTRIBUTING THE PRODUCTION** **08**

Shooting instructional productions, Audio for video, lighting for video, background - Television graphics, recording the video, editing, distributing hard copies of production, online distribution, live online distribution, internet protocol television, 3G/4G transmission.

**L-15;TOTAL HOURS-15**

**REFERENCES :**

1. Jim Owens, “Video Production Handbook”, Taylor & Francis, ISBN 1315530554, 2017.
2. Pierre A. Kandorfer, “Digital Video Production Handbook”, Xlibris Corporation, ISBN 1450003575, 2009.

**OUTCOMES :**

Students who complete this course will be able to

- Determine the production process
- Identify the production methods and techniques for applications

- Have an exposure on script writing and camera features.
- Address the audio and lighting features for video.
- Describe about television graphics and video recording.
- Address the features of online video distribution.

**CSC X128 MULTIMEDIA SECURITY L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To develop a basic understanding on the digital rights management systems.
- To identify possible countermeasures against threats and vulnerabilities in a given security scenario.
- Learn the requirements and mechanisms for identification and authentication.
- Know the mechanisms for securing the information using biometrics.
- To compare and contrast the underlying security mechanisms needed to implement security countermeasures.
- Have a deeper knowledge on embedded concepts of multimedia security.

**MODULE I FUNDAMENTALS OF MULTIMEDIA SECURITY 10**

Overview of Digital rights management systems, Putting Digital rights management in context, multimedia encryption, multimedia authentication, key management for multimedia authentication and distribution.

**MODULE II MULTIMEDIA SECURITY APPLICATIONS 10**

An overview of Digital watermarking, Biometrics in Digital rights management, Steganalysis, passive blind image forensics, security in digital cinema.

**MODULE III EMBEDDED MULTIMEDIA SECURITY 10**

Video coding, embedded systems and reconfigurable architectures and encryption basics.

**L-30;TOTAL HOURS-30**

**REFERENCES :**

1. Wenjun Zeng, Heather Yu, Ching-Yung Lin, “Multimedia Security Technologies for Digital Rights Management”, Academic Press, 2nd edition, ISBN: 9780123894768, 2011.
2. Amit Pande, Joseph Zambreno,” Embedded Multimedia Security Systems: Algorithms and Architectures”, Springer Science & Business Media, 2nd edition, ISBN:1447144597, 2012.

**OUTCOMES :**

Students who complete this course will be able to

- Identify the various threats and vulnerabilities

- Get familiarized on the concept of multimedia security and its issues
- Describe the requirements and mechanisms for identification and authentication.
- Determine appropriate mechanisms for protecting information
- Examine the issues related to video coding techniques.
- Have a deeper knowledge on embedded multimedia security.

**CSC X129 MULTIMEDIA COMMUNICATION AND NETWORKING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To summarize the principles and standards of multimedia
- Expound on the multimedia internet protocols.
- To identify the multimedia communication across the networks.
- To learn the various paradigms of compression techniques
- To expose on the basic idea and structure of switching networks
- Exemplify the features of a multimedia system and identify its suitability for the given task

**MODULE I INTRODUCTION 06**

Introduction- Multimedia networks - Multimedia applications- Applications and networking terminology – components of multimedia – file format of multimedia system

**MODULE II MULTIMEDIA COMPRESSION TECHNIQUES 08**

Quantization –Non-Linear Quantization- Differential encoding –Linear Prediction coding – Differential pulse code modulation – Lossless Compression – Runlength coding – Huffman Coding – Lossy Compression – Direct cosine transform – Wavelet transform

**MODULE III COMPRESSION STANDARDS 09**

JPEG Standards – Models – JPEG LS standard – JBIG – MPEG – MPEG 1 –MPEG 2 – MPEG 7 – MPEG 21

**MODULE IV INTERNET SERVICES 08**

IP datagrams -Fragmentation and reassembly-IP addresses- ARP and RARP - Routing algorithms – ICMP- QoS Services-IPv4- IPv6 - Transport protocols -UDP- RTP and RTCP

**MODULE V BROADBAND ATM NETWORKS 07**

Cell format - switching principles – Switch and Protocol architecture - entertainment networks and high speed modems- Cable TV networks-Satellite television networks-Terrestrial television networks

**MODULE VI COMMUNICATIONS ACROSS NETWORKS 07**

Packet Audio and Video in the network environment - Video transport across generic networks - transport across ATM networks – Multimedia across IP networks – Multimedia across DSLs – Internet access Networks – Multimedia across wireless mobile networks.

**L – 45; TOTAL HOURS- 45**

**REFERENCES :**

1. Kumar Krishna, Multimedia Communication, Pearson Education India, 2010. ISBN: 978-81-317-3238-0
2. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols, and Standards, Pearson Education, Fourth Edition, 2009 ISBN: 978-81-317-0994-8
3. C. T. Bhunia, Multimedia and Multimedia Communication, New Age International, 2009. ISBN: 81-2242-660-3

**OUTCOMES :**

Students who complete this course will be able to

- State of art techniques in multimedia communication
- Master using the appropriate compression technique for the given scenario
- Compare and contrast the various transport protocols
- Identify and solve problems in the fields of communication and networks.
- Design the communication and networking systems to meet desired specification
- Knowledge of recent technologies to enable them to face the world.

**CSC X130 GAMING TECHNOLOGY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 3 |

**OBJECTIVES :**

- To recognize principles of Game design and Game Engine design
- To know Good knowledge of implementing games in various platform
- To Making use of artificial intelligence in gaming
- To realize different types of animation
- To provide the foundation knowledge of gaming technology in computing
- To provide programming training in gaming technology , multimedia system design and implementations

**MODULE I FUNDAMENTAL OF GAME TECHNOLOGY** **07**

Games and Video Games -Conventional Games Versus Video Games-Games for Entertainment-Serious Games

**MODULE II DESIGNING AND DEVELOPING GAMES** **08**

An Approach to the Task-Key Components of Video Games-The Structure of a Video Game-Stages of the Design Process-Game Design Team Roles-Game Design Documents-The Anatomy of a Game Designer

**MODULE III UNDERSTANDING YOUR PLAYER** **09**

Vanden Berghe's Five Domains of Play-Demographic Categories-Gamer Dedication-The Dangers of Binary Thinking

**MODULE IV UNDERSTANDING YOUR MACHINE** **07**

Home Game Consoles-Personal Computers-Portable Devices-Other Devices

**MODULE V MAKING MONEY FROM YOUR GAME** **07**

Direct Payment Models-Indirect Payment Models-World Markets-Game Concepts-Getting an Idea-From Idea to Game Concept

**MODULE VI GAME WORLDS** **07**

Introduction-The Purposes of a Game World-The Dimensions of a Game World-Realism.

**L – 45; P-15; TOTAL HOURS-60**

**REFERENCES :**

1. Ernest Adams and Andrew Rollings,"Fundamentals of Game Design", Pearson Education 3 edition, ISBN-10: 9332540241,ISBN-13: 978-9332540248,2015
2. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications, A K Peters/CRC Press; 3 edition, ISBN-10: 1482250926, ISBN-13: 978-1482250923, 2015
3. Justin Plowman "3D Game Design with Unreal Engine, Packt Publishing Limited, ISBN-10: 1785881469, ISBN-13: 978-1785881466,,2016

**OUTCOMES :**

Students who complete this course will be able to

- Identify, choose, and implement appropriate algorithmic, programming, and mathematical techniques
- Develop software components for various aspects of computer games, such as character control, scene management, artificial intelligence, graphics and animation, etc.
- Create prototype games or game fragments by integrating original software components with existing professional tools, such as game engines, middleware, and common application programming interfaces.
- Develop and maintain software in a team environment using collaborative tools and technologies reflective of industry practices, including source control, build management, deployment, bug tracking, etc.
- Evaluate and select appropriate hardware and software platforms for a particular game strategy
- Design, create, and present a technical design document for a computer game or game component

**CSC X131 ROUTING PROTOCOLS L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To learn the basics of network routing protocol.
- To compare the difference between distance vector routing and link state routing.
- To discuss importance of Quality of Service(QoS) and traffic engineering in routing.
- To study the operations of gateway routing algorithms.
- To gain knowledge on ATM and Cellular wireless networks.
- To illustrate the design issues involved in various Mobile Ad Hoc and Sensor network routing algorithm.

**MODULE I NETWORK ROUTING BASICS 07**

Introduction to Networks - Network Architecture and Standards - Glimpse at the Network Layer - Addressing in TCP/IP Networks - Overview of Routing - Delivery, Forwarding, Routing, and Switching - Routing Taxonomy - Host Mobility and Routing - Introduction to basic Routing Algorithms - Routing Strategies - Non Adaptive Algorithms - Adaptive Algorithms - Flooding - Static Shortest Path Routing Algorithms - Dynamic Shortest Path Routing Algorithms - Stochastic Routing Algorithms.

**MODULE II FUNDAMENTAL ROUTING PROTOCOLS 08**

Routing Protocols - Distance Vector Routing - Working of the Protocol - Convergence of Distance Vector Table - Issues in Distance Vector Routing - Improvements in Distance Vector Routing - Advantages and Disadvantages - Link State Routing - Working of the Protocol - Routing Tables - Path Vector Routing - Working of the Protocol - Unicast, Multicast, and Broadcast Routing .

**MODULE III QUALITY OF SERVICE AND TRAFFIC ENGINEERING 07**

Introduction - QoS Measures - Differentiated and Integrated Services - QoS Routing Algorithms - QoS Unicast Routing Protocols - QoS Multicast Routing Protocols - QoS Best Effort Routing - Routing and MPLS Traffic Engineering - MPLS Fundamentals - Traffic Engineering Routing Algorithms - Minimum Interference Routing Algorithm - Profile Based Routing Algorithm - Dynamic Online Routing Algorithm - Wang et al.’s Algorithm - Random Races Algorithm.

**MODULE IV INTERNET ROUTING 08**

Interior Gateway Protocols - Distance Vector Protocols - Routing Information Protocol -

Interior Gateway Routing Protocol - Link State Protocols - Open Shortest Path First Protocol - Intermediate System to Intermediate System Protocol - Exterior Gateway Protocol - Hosts vs Gateways - Gateway to Gateway Protocol - Autonomous System - Characteristics of EGP - Evolution of EGP Standards - EGP Terminology and Topology - EGP Operation Model - Border Gateway Protocol.

**MODULE V ATM AND CELLULAR WIRELESS NETWORKS 06**

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

**MODULE VI MOBILE AD HOC NETWORKS AND SENSOR NETWORKS 09**

Routing in Wireless Ad Hoc Networks - Basics - Issues with Existing Protocols – Table Driven (Proactive), On Demand (Reactive), Hybrid, Hierarchical, Geographic, Power Aware Routing Protocols - Routing in Wireless Sensor Networks - Basics -- Hardware Architecture of Sensor Node - Network Topology - Design Factors - Classification of Routing Protocol - Routing Challenges in Wireless Sensor Networks - Flat Routing Protocols - Hierarchical Routing Protocols - Location Based Routing Protocols - Multipath Routing Protocols - Query Based Routing Protocols - Negotiation Based Routing Protocols - QoS Routing Protocols – 6LowPAN.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Sudip Misra, Sumit Goswami, “Network Routing: Fundamentals, Applications, and Emerging Technologies”, Wiley publication, ISBN: 978-0-470-75006-3, 2017.
2. Deepankar Medhi, Kartikeyan Ramasam , "Network Routing - Algorithms, Protocols, Architecture - 2nd Edition ", Morgan Kauffman Series Publication, ISBN: 9780128008294, 2017.
3. Mounir Frikha , “Ad Hoc Networks: Routing, Qos and Optimization”, Wiley-ISTE, ISBN: 978-1-84821-227-5, 2011.
4. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks - Principles, Protocols and Applications", 2nd Edition, Auerbach publications, 2008.

**OUTCOMES :**

Students who complete this course will be able to

- Acquire knowledge on fundamentals of network routing protocol.
- Analyze the working of distance vector routing and link state routing protocol.
- Inspect the QoS and traffic engineering parameters in different routing algorithms.
- Compare the characteristics of Internet routing protocols.
- Explore the network topology of ATM and Cellular wireless networks.
- Relate the issues in existing routing protocol and mobile routing protocols.

**CSC X132** **QUEUING THEORY** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To develop the modeling and mathematical skills for network design.
- Analytically determine computer systems and communication network performance.
- To read and understand the current performance analysis and queuing theory literature upon completion of the course.
- Elaborate strengths and weaknesses of Queuing Models.
- Impart knowledge of Queuing models and its applications to enable them to apply them for solving real world problems.
- To expose the students for modeling practical, present and future telecommunications traffic and networking applications.

**MODULE I INTRODUCTION 07**

Basic System Elements - Problems in a Queuing System - Probability Distributions as Models - Identification of Models - Distribution Selection - Basic Concepts in Stochastic Processes.

**MODULE II MARKOVIAN QUEUING SYSTEMS 07**

A General Birth and Death Queuing Model - The Queue M/M/1 - The Queue M/M/s - The Finite Queue M/M/s/K - The Infinite Server Queue M/M/∞ - Finite Source Queues - Other Models - Imbedded Markov Chains - The Queue M/G/1 - The Queue G/M/1 - Extended Markov and Renewal Models.

**MODULE III QUEUING NETWORKS 07**

The Markovian Node Network - Queues with Blocking - Open Jackson Networks - Closed Jackson Networks - Cyclic Queues - Matrix-Analytic Queuing Models - Phase Type Distributions - Markovian Arrival Process - Analysis of Queuing Models Using MAM – The Queue G/G/1 and Approximations - Bounds for Mean Waiting Time - Little's Law $L = \lambda W$ – Approximations.

**MODULE IV STATISTICAL INFERENCE 08**

Birth and Death Process Models - Imbedded Markov Chain Models for M/G/1 and G/M/1 - The Queue G/G/ 1.

**MODULE V METHODS OF ESTIMATION 08**

Tests of Hypotheses - Control of Traffic Intensity in M/G/1 and G/M/1 - Decision Problems in Queuing Theory - Performance Measures - Design Problems in Decision-Making - Control Problems in Decision-Making.

**MODULE VI COMPUTER AND COMMUNICATION SYSTEMS 08**

Modeling Computer Systems - Modeling Communication Systems - Modeling and Analysis using Computational Tools - Simulating Queuing Systems - Using MATLAB - Other Tools for Simulating and Analyzing.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. “An Introduction to queuing theory modeling and analysis in applications”, Bhat, U. Narayan, 2015, ISBN: 978-0-8176-8420-4.
2. “Fundamentals of Queueing Theory”, Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris, 2008,4th Edition, ISBN: 978-0-471-79127-0.
3. Queueing Theory for Telecommunications, AttahiruSule Alfa, Springer US, 2010, 978-1-4419-7313-9.

**OUTCOMES :**

Students who complete this course will be able to

- Define and explain basic concepts in descriptive statistics and probability theory.
- Solve some standard problems that include Queuing systems.
- Define and explain basic concepts in the theory Markov processes, M/M/m, M/M/m/K and M/M/m/K/C queuing systems.
- Derive and apply main formulas for some properties (such as stationary probabilities, average waiting and system time, expected number of customers in the queue, etc. ) of M/M/m, M/M/m/K and M/M/m/K/C queuing systems.
- To estimate the traffic intensity, blocked traffic and the utilization of some queueing systems.
- Analyze and solve problems using computer aid (Maple, Matlab or Mathematica).

**CSC X133 NETWORK TROUBLESHOOTING TOOLS**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- Give an in-depth training on Wireshark and TCP/IP communications analysis.
- Use Wireshark to identify the most common causes of performance problems in TCP/IP communications.
- Develop a thorough understanding of how to use Wireshark efficiently to spot the primary sources of network performance problems
- To be able to provide effective packet analysis.

**MODULE I NETWORK ANALYSIS 06**

Introduction to Network Analysis and Wireshark - Capture Methods and Capture Filters - Customize for Efficiency: Global Preferences Configuration – Quick Navigation and Colouring Techniques - Network and Application Issues with Time Values and Summaries - Creation and Interpretation of Basic Trace File Statistics - Traffic Analysis Using Display Filters.

**MODULE II TRAFFIC ANALYSIS 09**

TCP/IP Communications and Resolutions Overview - DNS Traffic Analysis - ARP Traffic Analysis - IPv4 Traffic Analysis - ICMP Traffic Analysis - UDP Traffic Analysis - TCP Protocol Analysis - Graph Traffic Characteristics Analysis - HTTP Traffic Analysis - TLS-Encrypted Traffic (HTTPS) Analysis.

**Lab Exercises:**

- Capture Traffic to/from the Hardware Address
- Create a Troubleshooting Profile & Set Basic Preferences for Your Troubleshooting Profile
- Find, Mark, Save, and Colorize Packets, Detect and Colorize High Latency Indications
- Find the Top Talkers and Protocols/Applications on a Network
- Create and Use an IO Graph to Spot Performance Issues
- Locate a Text String in a Trace File
- Create a Coloring Rule to Detect DNS Error Responses and Suspicious DNS Responses
- Analyze a Network Problem Indicated by ARP

- Filter on a Range of IPv4 Addresses
- Detect Suspicious Traffic with a New ICMP Coloring Rule
- Analyze UDP-Based Multicast Streams and Queuing Delays
- Use an IO Graph to Locate TCP Performance Issues
- Determine the Cause of Slow File Downloads
- Use TCP Graphs to Detect the Cause of Performance Problems
- Create a Filter Expression Button to Detect HTTP Error Responses
- Export an HTTP Object
- Decrypt HTTPS Communications

**L-15;TOTAL HOURS-15**

**REFERENCES :**

1. Anish Nath, " Packet Analysis with Wireshark",Packt Publishing, 1st Edition, 2015.
2. Laura Chappell , "Wireshark Network Analysis: the Official Wireshark Certified Network Analyst™ Study Guide", 2nd Edition, Protocol Analysis Institute, Inc, dba Chappell University, 1-893939-94-4, 2015.
3. https://www.wireshark.org/docs/

**OUTCOMES :**

Students who complete this course will be able to

- Troubleshoot and optimize TCP/IP networks
- Analyze the network traffic with Wireshark
- Detect Suspicious Traffic in the network
- Detect and report the causes of performance problems

| CSC X134 | DESIGN OF COMPUTER NETWORK SERVICES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To expose multimedia services with real-time and non real-time components delivered over the Internet.
- To gain knowledge about various QoS and QoE measures for audio and video streams.
- To illustrate the protocols for SIP and IMS for setting up multimedia services.
- To study the various architectures and protocols to provide QoS guarantees in the IP network.
- To identify the parameters influencing the control functions.
- To provide an overview on the various models for capacity planning.

**MODULE I BASICS OF NETWORK SERVICES 06**

Network services basics - Process-Services: Definition, Characteristics and Frameworks-IT infrastructure Library-Process Modeling - Process design patterns - Example using BPMN

**MODULE II QUALITY OF SERVICE & QUALITY OF EXPERIENCE 08**

QoS measures- Subjective evaluation of voice and video quality- Objective evaluation of audio and video quality - Session initiation protocol(SIP) - Format of a SIP message- SIP response messages - SIP methods-Session description protocol - Examples of SIP messages - Locating SIP servers

**MODULE III IP MULTIMEDIA SUBSYSTEM 09**

IMS entities and functionalities - User identification - Setting up a session in IMS -Service provision - Setting up an emergency IMS session - SIP compression - Networking Services over IMS - Multimedia Service Continuity-VPN

**MODULE IV QOS ARCHITECTURES IN THE TRANSPORT NETWORK 06**

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

**MODULE V CONTROL FUNCTIONS 09**

Traffic characterization - Congestion control - QoS and Bandwidth requirements - The resource and admission control functions - MPLs virtual private networks - VPN models - pseudowires – Ethernet pseudowires –Virtual private LANservice.

**MODULE VI CAPACITY PLANNING 07**

Measuring the response time of Solr - Performance modeling - Some basic concepts of Queuing models - Simulation Project.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Harry Perros, Networking Services QoS, Signaling, Processes, Createspace Independent Publications, ISBN: 1495437485, 978-1-49-543748-9, 2014.
2. Peterson, Larry L., and Bruce S. Davie, Computer networks: a systems approach, Elsevier, ISBN:978-0-12-374013-7, 2012.
3. Jin, Cheng, Jamin Sugih, Danny Raz, and Yuval Shavitt, Building scalable network services: theory and practice, Springer Science & Business Media, ISBN: 978-1-44-198897-3, 2011.

**OUTCOMES :**

Students who complete this course will be able to

- Identify the attributes that impact the network services.
- Assess the QoS and QoE measures of audio and video streams.
- Summarize the functionalities of IP multimedia subsystem.
- Compare the different Qos architecture along with their protocols.
- Analyze the control functions with the underlying transport network and assess Qos of a multimedia session.
- Design capacity planning models for real time scenarios.

**CSC X135 SOFTWARE ARCHITECTURE FOR THE INTERNET OF THINGS**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To contexts of software architecture: technical, project, business, and professional.
- To use various architecture styles for Internet of things devices.
- To provide architecture competence: what this means both for individuals and organizations.
- To emphasize on architecturally significant requirements, and how to determine them.
- To describe essential technical knowledge, building blocks, processes, design principles, implementation, and marketing for Internet of things projects.
- To provide readers with knowledge in planning, designing, and implementing IoT projects.

**MODULE I SOFTWARE ARCHITECTURE 07**

Software Architecture – Many context of architecture – Quality attributes – Three architecture in life cycle – Designing architecture.

**MODULE II INTERNET OF THINGS ARCHITECTURE 08**

Architecture and Business - Introduction to Internet of things – Architectural approaches- Business Architecture – Technology architecture – Software architecture for Internet of Things- Security and governance- Applications.

**L-15;TOTAL HOURS- 15**

**REFERENCES :**

1. Len Bass, Paul Clements, Rick Kazman," Software Architecture in Practice", Addison-Wesley, 3rd Edition, ISBN: 9780132942782, 2012.
2. Rajkumar Buyya, Amir Vahid Dastjerdi," Internet of Things: Principles and Paradigms", Elsevier, 1st Edition, ISBN: 9780128093474, 2016.
3. Hwaiyu Geng," Internet of Things and Data Analytics Handbook, John Wiley & Sons, 1st Edition, ISBN: 9781119173649,2017.

**OUTCOMES :**

Students who complete this course will be able to

- Design architecture for the IoT devices based on the application.

- Develop various styles of pattern of software architecture based on application.
- Achieve system quality that can be applied to subsequent systems.
- Captures the state-of-the-art research in Internet of Things, its applications, architectures, and technologies.
- Think on new innovations and interactions between people and things that will enhance the quality of life and utilization of scarce resources.
- Test the devices and enhance the architecture to provide high security models.

**CSC X136** **SOFTWARE METRICS** **L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To learn the software metrics and measurement.
- To emphasize the use of product and quality metrics.
- To explain quality assurance and various tools used in quality management
- To learn in detail about various quality assurance models
- To learn the audit and assessment procedures to achieve quality
- To expose the students to apply certain probability, statistical and operational research concepts

**MODULE I INTRODUCTION TO SOFTWARE METRICS 10**

Fundamentals of measurement-Scope of software metrics-Measurement theory-Software measurement validation software metrics data collection – Analysis methods.

**MODULE II PRODUCT AND QUALITY METRICS 10**

Measurement of internet product attributes-size and structure-external product attributes-measurement of quality- Software quality metrics-product quality-process quality- metrics for software maintenance.

**MODULE III FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 10**

SQA basics-Software quality in business context – Planning for software quality assurance – Product quality and process quality – Software process models -Total Quality Management- 7 QC Tools and Modern Tools.

**L-30;TOTAL HOURS- 30**

**REFERENCES :**

1. S.A.Kelkar,”Software quality and Testing”, PHI Learing, Pvt, Ltd.,1st Edition,ISBN: 9788120346284, 2012.
2. Norman E-Fentor and Share Lawrence Pflieger,“Software Metrics”,International Thomson Computer Press,2nd Edition,ISBN: 9781850322757, 1997.
3. Watts S Humphrey, “Managing the Software Process”, Pearson Education Inc,2nd Edition,ISBN: 978-0201180954,2008.

**OUTCOMES :**

Students who complete this course will be able to

- Gain knowledge on how to choose which metrics to collect and use them to make predictions.
- Explain the product and quality metrics.
- Detect, classify, prevent and remove defects.
- Choose appropriate quality assurance models and develop quality.
- Conduct formal inspections, record and evaluate results of inspections.
- Acquire skills in handling the quality management.

**CSC X137 MULTICORE ARCHITECTURE L T P C**

**2 1 0 3**

**OBJECTIVES :**

- To introduce the fundamentals of parallel Programming.
- To introduce the basic concepts of IoT
- To introduce the importance of the underlying architecture
- To explore the basic approach of synchronization
- To explain the emerging transactional approach to concurrency
- To expose the concept of parallel Programming

**MODULE I INTRODUCTION 06**

Definitions – Technological Aspects - Design Principles of Connected Devices - Fundamentals of IPv6 – Addressing and Protocols relevant to IoT - Smart Cities and Environments – Smart Metering –

**MODULE II APPLICATION 06**

Applications in Security – Healthcare – Retail – Industrial Control –Smart Farming and Agriculture

**MODULE III FOUNDATIONS OF SHARED MEMORY 08**

Register construction – Atomic snapshots – Power of Primitive Synchronization Operations – Universality of Concensus – Spin Lock and Contention

**MODULE IV SYNCHRONIZATION 08**

Monitors and Blocking Synchronization – Role of Locking – Concurrent Queues – ABA Problem – Concurrent Stacks and Elimination.

**MODULE V CONCURRENT DATA STRUCTURES 08**

Counting, Sorting and distributed coordination – Concurrent hashing and Natural Parallelism – Multiprocessor Scheduling and Parallelism - Barriers – Transactional Memory.

**MODULE VI PARALLEL PROGRAM DEVELOPMENT 09**

Two n-Body Solvers – Tree Search – Pthreads – OpenMP – MPI.

**L – 30; T-15;TOTAL HOURS-45**

**REFERENCES :**

1. Maurice Herlihy, Nir Shavit, The Art of Multiprocessor Programming, Morganaufmann, 1st Edition, 2012, ISBN: 978-0-12-370591-4.
2. Peter Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann,1st Edition, 2011, eBook ISBN: 978-0-080-92144-0.

**OUTCOMES :**

Students who complete this course will be able to

- Write effective multiprocessor programs.
- Identify the protocols relevant to IoT application
- Compare and contrast various parallel algorithms using shared memory
- Apply barriers, all of which are useful for structure concurrent applications
- Demonstrate synchronization and parallelism
- Able to analyze the results for various multiprocessor scheduling.

**CSC X138** **STATISTICS AND ANALYTICS USING R PROGRAMMING**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**OBJECTIVES :**

- To teach basic of R programming.
- To express the sample data visually using charts, graphs and plots.
- To diagnose the research problem and set the objectives.
- To emphasise the need for confidence intervals and estimation of error rates.
- To evolve the statistical inference and summarize the inferences.
- To develop regression models and evaluate the findings
-

**MODULE I BASIC CONCEPTS 08**

Introduction to R, Variables and the Case Format, Central Tendency and Variability, Descriptive Statistics, Data acquisition and inspection, PDFs and CDFs, Using the Normal Model.

**MODULE II CHARTS, GRAPHS, AND PLOTS 08**

Bar Charts, Histograms, Segmented Bar Charts, Box Plots, Comparative Box Plots, Pie and Waffle Charts, Pareto Charts. QQ Plots and Tests for Normality, Scatterplots, Contingency Tables

**MODULE III FOUNDATIONS FOR RESEARCH 08**

Randomness and Sampling Strategies, Experiments vs. Observational Studies, R's 12 Steps, The Art of Developing Research Questions, Power Analysis to Determine Sample Size, Sampling Distributions and The Central Limit Theorem, P-Values, Confidence Intervals and Controversy.

**MODULE IV CONFIDENCE INTERVALS AND STANDARD ERROR 07**

One Mean, Two Means, Paired Means, One Proportion, Two Proportions, One Variance, Two Variances, Regression Slope and Intercept.

**MODULE V STATISTICAL INFERENCE 07**

One Sample t-test, Two Sample t-test (Equal Variance), Two Sample t-test (Unequal Variance), Paired t-test, One Proportion z-test & Binomial Test, Two Proportion z-test, Chi-square Test of Independence, Chi-square Test for One

Variance, F Test for Homogeneity of (Two) Variances, One-way Analysis of Variance (ANOVA)

**MODULE VI REGRESSION AND INFERENCES ON REGRESSION 07**

Simple Linear Regression, Multiple Regression, Hypothesis Tests of Regression Coefficients, Real time case study and inference presentation.

**L – 30; P – 30 TOTAL HOURS-60**

**REFERENCES :**

1. Nicole M. Radziwill, “Statistics (The Easier Way) with R: an Informal Text on Applied Statistics”, Lapis Lucera Publishers, ISBN-13: 978-0692339428, 2015.
2. John M. Quick, “Statistical Analysis with R – Beginner’s Guide”, Packt Publishing, ISBN: 9781849512084, 2010.
3. Richard Cotton, “Learning R”, O'Reilly Publications, First edition, ISBN-13: 978-9351102861, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Acquire the basics of R programming and apply it for statistical problem solving
- Study the given samples set and express using visual tools like charts, graphs and plots.
- Formulate the research problem and set the objectives
- Distinguish between the confidence error intervals and estimate the error rate.
- Apply Statistical inferences and propose actions based on the findings.
- Analyse a given real time scenario, apply regression and interpret the results.

**CSC X139** **C# .NET** **L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To learn the .NET Architecture
- To explain the strings, collections and exceptions.
- To learn the object oriented concepts and the application
- To acquire the knowledge of windows applications.
- To describe the Server side programming with ADO.NET data Access.
- To explain the Simple Object Access Protocol (SOAP) and ASP.NET Web Services.

**MODULE I INTRODUCTION TO C# 10**

.NET Architecture - Core C# -Objective and Types – Arrays - Operators and Casts – Strings – Collections - Errors and Exception.

**MODULE II OBJECT ORIENTED ASPECTS OF C# 10**

Classes - Objects-Inheritance - Polymorphism-Interfaces – Operator Overloading – Delegates – Events- Building Windows Applications - Accessing Data with ADO.NET

**MODULE III .NET FRAMEWORK 10**

Understanding Server Object Types - Specifying a server with an Interface - Building a server, Building the Client - Using Single Call -Threads - Develop ASP.NET Web Services - Web Services (SOAP).

**L-30;TOTAL HOURS- 30**

**REFERENCES :**

1. Christian Nagel,Bill Evjen,Jay Glynn,"Professional C# 2012 and .NET 4.5",2nd Edition,ISBN:978-1-118-31442-5,2013.
2. E.Balagurusamy , "Programming in C#", Pearson Education, 7th Edition, ISBN: 978813170205, 2002.
3. J. Liberty, "Prgramming in C#", O'Reilly", 2nd Edition, ISBN: 0-596-00309-9, 2002.

**OUTCOMES :**

Students who complete this course will be able to

- Develop and deploy the concepts of object oriented programming.
- Utilize the .NET framework to build distributed enterprise applications.
- Develop the experiment with the deployment of windows applications.

- Develop the ASP.NET Web Services and threads.
- Develop network applications using Web Services (SOAP).
- Build the client and server side programming using single call.

**SEMESTER VI**

**Programme Elective ##3**

**Elective 1**

| | | | | | |
|---|---|---|---|---|---|
| **CSC X214** | **INFORMATION RETRIEVAL** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

**OBJECTIVES :**

- To recall the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To introduce the IR principles to locate relevant information on large collections of data.
- To evaluate the performance of an information retrieval system.
- To acquire knowledge and experience of the XML programming language.
- To describe the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To expose the document text mining techniques.

**MODULE I INTRODUCTION 07**

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

**MODULE II MODELING 07**

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.

**MODULE III INDEXING 07**

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

**MODULE IV CLASSIFICATION AND CLUSTERING 09**

Text Classification and Naïve Bayes – Vector Space Classification – Support vector

machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

**MODULE V SEARCHING THE WEB 08**

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

**MODULE VI DOCUMENT TEXT MINING 07**

Information filtering - organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

**L – 30; P-30;TOTAL HOURS-60**

**REFERENCES :**

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, “Modern Information Retrieval: The concepts and Technology behind Search” (ACM Press Books), Second Edition, ISBN 10: 0321416910, 2011.
2. Stuart Russell-Peter Norvig, "Artificial Intelligence - A Modern Approach", 3rd Edition, Pearson Education, ISBN-10: 0-13-604259-7, 2009.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, ISBN-10: 0136072240, 2009.

**OUTCOMES :**

Students who complete this course will be able to

- Apply the basic concepts and techniques of Information Retrieval in various related fields.
- Form the ontology for different domains and generate the equivalent representations.
- Use different information retrieval techniques in various application areas
- Implement retrieval systems for web search tasks.
- Develop skills in problem solving using systematic approaches.
- Apply document text mining techniques and analysis.

**CSC X215 SOFTWARE RISK MANAGEMENT L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To give an insight into the various risk levels in software development
- To provide a concise view on the risk plan
- To highlight the techniques in identifying risks.
- To realize the need for managing and tracing risks.
- To gain expertise in discovering risk and usage of risk assessment tools
- To highlight risk mitigation strategies.

**MODULE I RISK MANAGEMENT PROCESS 07**

Introduction to software risk management-objectives and goals-assessment-cost-developing a software risk management strategy-Risk management paradigm-cultural considerations

**MODULE II RISK ASSESSMENT, MITIGATION AND MONITORING 08**

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

**L-15; TOTAL HOURS-15**

**REFERENCES :**

1. John McManus, “Risk Management in Software Development Projects”, Route Ledge, ISBN: 1136367918, 9781136367915 ,2012
2. Tom DeMarco, Tim Lister, Waltzing with Bears: Managing Risk on Software Projects, Addison-Wesley, ISBN 0133492230, 9780133492231., 2013.
3. Hall, Elaine M.” Managing Risk: Methods for Software Systems Development”, Addison Wesley, ISBN 0201255928, 2001.

**OUTCOMES :**

Students who complete this course will be able to

- Identify risks associated with a project.
- Categorize risks and Develop basic risk management skills.
- Develop a comprehensive risk management plan for a project.
- Qualitatively and quantitatively analyze risks and assess risks.
- Apply risk mitigation strategies.
- Evaluate risk management tools and explore them.

**CSC X216** **SOCIAL MEDIA SECURITY** **L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To understand how to apply the principles of security in social media.
- To understand the vulnerabilities and threats in Social Media.
- To learn about the policies and procedures in Social Media Security.
- To identify and mitigate social media security risks.
- To learn the importance of security in social media.
- To overcome the privacy issues in social media.

**MODULE I** **UNDERSTANDING THE INFLUENCE OF SOCIAL MEDIA GLOBALLY** **09**

Overview of Social Media - Understanding Social Media's Impact on Global Security – Social Media Analytics- collecting and Managing Social Media Data

**MODULE II** **SECURITY ISSUES IN SOCIAL MEDIA** **10**

Risks of Social Media – Cyber Crime – Fake Accounts – Passwords – Content Security –Malware and Viruses

**MODULE III** **POLICIES AND PRIVACY** **11**

Laws and Regulations- forensics –Blocking users – Location Awareness

**L-30;TOTAL HOURS-30**

**REFERENCES :**

1. Ravi gupta & Hugh Brooks, "Using Social Media for Global Security",John Wiley Publishers, ISBN: 9781118442319,2013.
2. Michael Cross, "Social Media Security", Elsevier Publishers, ISBN: 9781597499866, 2014.
3. Yaniv Altshuler, Yuval Elovici, "Security and Privacy in Social Networks", Springer Publishers, ISBN: 9781461441380, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Evaluate the importance of security issues in social media.
- Analyze and provide security solutions.

- Overcome the vulnerabilities and threats in social media.
- Acquire knowledge about security issues and services available.
- Identify and respond to significant legal and ethical issues related to social media including laws and voluntary agreements covering protection of individual information protection.
- Identify privacy and data integrity issues associated with social media to identify both personal and institutional data privacy threats and maintain both personal and institutional data integrity.

**CSC X217** **WEB SECURITY** **L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To learn about the security concepts, security professional roles, and security resources in the context of systems and security development life cycle.
- To acquire the knowledge of threat and risk analysis.
- To explain the business need for web security threats and secure software development.
- To learn about the information of secure socket layer and transport layer security.
- To expose the students to apply the use of firewall and packet filtering firewall in physical design.
- To explain the concepts and techniques for establishing system security.

**MODULE I SECURITY WORLD 10**

History of Web Security-Black and White Hat-Security Elements-Asset Classification-Threat & Risk Analysis-Security of Browser-Cross-Site Scripting Attack – Introduction-Advanced XSS Attack-Platform.

**MODULE II WEB SECURITY 10**

Web Security Considerations- Web security threats- Web traffic security approaches-Secure Socket Layer and Transport Layer Security- Overview- HTTPS- Connection initiation- Connection closure- Basic Concept of Secure Electronic Transactions- SSL versus SET- D Secure Protocol.

**MODULE III SYSTEM SECURITY 10**

Intrusion- Classification of Intruders- Intrusion Detection techniques- Password Management- Malicious software- Virus Countermeasures- Need of firewall- Firewall characteristics- Types of Firewall- Packet filtering firewall- Application proxy firewall-Circuit level proxy firewall.

**L-30;TOTAL HOURS- 30**

**REFERENCES :**

1. Hanqing Wu and Liz Zaho,”Web Security”,1st Edition,CRC Press,ISBN: 9781466592612,2015.
2. Eric Malwald, “Fundamentals of Network Security “, 4th edition., Pearson

Education, ISBN: 978-0072230932,2010.

3. William Stallings,"Cryptography and Network security", 4th edition., Pearson Education, ISBN: 10: 0131873164,2008.

**OUTCOMES :**

Students who complete this course will be able to

- Describe importance of web security and attack.
- Explain Basic concept of web traffic security approaches.
- Identify the concept of secure socket layer.
- Demonstrate use of malicious software.
- Apply Application level security on web browser.
- Apply various parameters of antivirus and firewall security on network.

**CSC X218 SOFTWARE DESIGN AND ARCHITECTURE**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To provide a concise overview of the basics and characteristics of software architecture.
- To provide an understanding of software development with an emphasis on architecture and design.
- To highlight the architectural patterns and models.
- To understand the principles of software quality concepts and quality attributes.
- To outline the various architectural styles and design strategies.
- To acquire knowledge on documentation of software architecture

**MODULE I SOFTWARE ARCHITECTURE AND QUALITY ATTRIBUTES 07**

Software Architecture- Importance – Contexts of software architecture – Quality attributes – Availability – Interoperability – Modifiability – Performance – Usability – other Quality attributes

**MODULE II DESIGN AND MODELLING 08**

Architectural tactics and patterns – Frameworks - Quality attribute modeling and analysis – Architecture in Agile Projects .Architectural Styles – Designing an Architecture – Design Strategy – Attribute Driven Design Methods – Documenting Software Architecture.

**L-15;TOTAL HOURS- 15**

**REFERENCES :**

1. Len Bass, Paul Clements, Rick Kazman,"Software Architecture in Practice", Addison-Wesley, 3rd Edition, ISBN – 97801321815736, 2015.
2. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Robert Nord, Judith Stafford "Documenting Software Architectures: Views and Beyond ", 2nd edition, Pearson Education, ISBN: 0132488590, 9780132488594, 2011.
3. Taylor, R., Medvidovic, N., Dashofy, E., "Software Architecture: Foundations, Theory, and Practice", Wiley. ISBN: 9780470167748, 2010.

**OUTCOMES :**

Students who complete this course will be able to

- Identify and assess the quality attributes of a system at the architectural level.
- Select patterns and architectures for applications of various domains.
- Develop software that meets specific quality constraints by understanding the impact of architecture, design and implementation.
- Recognize major software architectural styles, design patterns, and frameworks.
- Apply the knowledge of various architectural tactics and styles in given scenario.
- Illustrate the skills to document software architectures.

**CSC X219 SOFTWARE CONFIGURATION MANAGEMENT L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To learn the importance of integrity and control of system components throughout SDLC.
- To develop code in parallel with other developers.
- To analyze where the change happened in the history of a component development.
- To learn an environment focused on producing quality products.
- To have a knowledge on deciding when to use manual processes.
- To use current tools effectively.

**MODULE I INTRODUCTION 10**

Introduction – Pitfalls in SDLC – Importance of SCM – Basic concepts – Configuration Identification.

**MODULE II CONFIGURATION CONTROL 10**

Configuration control – Defect Classification – Defect controls – Status Accounting – Verification and Audits – CMM.

**MODULE III SCM TOOLS 10**

Introduction – SCM Tools Evolution – Advantages – Functions – Tools Selection – Documentation Management- SCM Implementation – Phases of SCM Implementation – SCM and Cloud Computing – Code Repositories – Operations on SCM system.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Alexis Leon, "Software Configuration Management Handbook", Artech House, Third Edition, ISBN 978-1-60807-843-1, 2015.
2. 2
3. Maria E Moriera, “Software Configuration Management Implementation Roadmap", John Wiley & Sons , ISBN 0-470-86264-5, 2004.

**OUTCOMES :**

Students who complete this course will be able to

- Recognize every configuration item of a software product.
- Apply the formal mechanisms for making changes to configuration items.
- Identify and control defects in a software application.
- Document the project plan per the chosen structure and format.
- Track the changes using the software configuration management system.
- Check the availability of the resource and support their team in the development process

| CSC X220 | HUMAN COMPUTER INTERACTION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To understand the basics of foundation for User Interface.
- To describes guidelines for effective interface designs.
- To equip with the human factor methodologies
- To provide the design technology for individuals and persons with disabilities
- To identify the various models that can be used for designing systems.
- To provide guideline for testing and modeling for interactive design

**MODULE I INTRODUCTION 10**

Usability of Interactive Systems - Universal Usability - Guidelines, Principles, and Theories. Design - Evaluation and the User Experience.

**MODULE II INTERACTION STYLES 10**

Direct Manipulation and Immersive Environments - Fluid Navigation - Expressive Human and Command Languages – Devices - Communication and Collaboration.

**MODULE III DESIGNING ISSUES 10**

Advancing the User Experience - The Timely User Experience - Documentation and User Support - Information Search - Data Visualization.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Ben Shneiderman, Catherine, Maxine Cohen,"Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition, ISBN-9780134380711, 2017.
2. I.Scott Mackenzie,"Human-Computer Interface: An Emprical Research perspective", Elsevier, ISBN: 978012405865, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Explore and analyze the basic concepts, terms in user interface
- Explain the guidelines for effective interface designs.

- Apply the Interaction design basics.
- Design the effective HCI for individuals and persons with disabilities.
- Recognize the importance of human factors.
- Develop an interactive user interface.

**CSC X221** **GREEN COMPUTING** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To create awareness of energy efficient computing.
- To examine the power management in computing devices.
- To emphasize skill in energy saving practices in their use of hardware.
- To explore the technology tools that can reduce paper waste and carbon footprint.
- To understand how to minimize equipment disposal requirements.

**MODULE I INTRODUCTION 08**

Reputation as Motivation-Avoiding Green wash-Green Recruiting and Retention-Money saving efforts-Implementing Energy Efficiency-Current Devices –Digitizing NON-IT Functions.

**MODULE II GREEN COMPUTING ENVIRONMENT 08**

Environmental Drivers-Green Agenda-Roots of Environmentalism-Environmentalism and IT-Imperative of Climate Change-Go Green-A New vision of computing-Efficiency and cloud computing-Green ability-responsibility-usability-the zen of green computing

**MODULE III GREEN DEVICES 08**

Device purchases-Dimension of Device pyramid greeness-Green computing-Embodied Energy-Device Green-Supplier Green-Buying principles-Desktop computers-Laptops.

**MODULE IV GREEN DATACENTERS 07**

Green Data Centers-Model-Power supply considerations-servers-storage-networking-datacenter suppliers-saving energy-Cost savings-Risk Reduction-Carbon Footprint Reduction-Focusing on solar power.

**MODULE V GREEN HOUSE GAS AND RESOURCE 07**

Sources and sinks of green house gases and warming-doubters-deniers-Reducing Emissions-Resource use check list-Apple-EPEAT-Case Study-Computer Hardware and RSI

**MODULE VI DEEP GREEN COMPUTING 07**

Megatrends for Green computing-Telepresence-Telecommuting-Platforms for Deep Green computing-Selling Deep Green Computing

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Bud E. Smith,"Green Computing: Tools and Techniques for Saving Energy, Money, and Resources",CRC Press,1st Edition,ISBN:9781466503410,2014
2. Wu Chun Fang, "Green computing Book", CRC Press,1st Edition,ISBN:9781439819876, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Describe the resources pertaining to green house gases and warming.
- Develop energy efficient computing applications.
- To analyze the consumption of power in data centers.
- Evaluate deep green computing use in relation to environmental perspectives.
- Discuss how the choice of hardware and software can facilitate a more sustainable operation.
- Apply the strategies of going Green.

**CSC X222 XML and WEB SERVICES L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To provide overview on evolution of web services and their architecture.
- To describe, discover & develop web services.
- To inculcate in-built programming skill needed to provide a web service.
- To learn the trade-offs and issues that are involved in designing a web service.
- To demonstrate on how to validate XML documents with the use of Document Type Definitions and XML schemas.
- To practice the technologies in building the web services.

**MODULE I XML FUNDAMENTALS 10**

XML Fundamentals: XML Documents - XML namespaces - Explicit and Default namespaces, Inheriting namespaces - XML Schema - Implementing XML schema types, Elements, Inheritance, Substitution groups, Global and local type declarations, Managing Schemas, Schemas and instance documents, XML schema best practices.

**MODULE II WEB SERVICES 10**

Introduction: Web services - SOAP – SOAP message format – SOAP communication style – WSDL – WSDL building blocks – containment structure of a WSDL document – logical relationships between WSDL elements - UDDI - UDDI Business registry- Accessing UDDI – UDDI API – Private versus Public UDDI registries

**MODULE III BUILDING WEB SERVICES 10**

Developing web services in Java – IBM development tools – preparing sample applications – Building web services clients – Programmatic access to WSDL – UDDI access from Java and web browsers.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, “Web Services: Concepts, Architectures and Applications”,Springer, Illustrated Edition, ISBN:3662108763, 2013.
2. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,“ Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World”, Springer,2nd Edition, ISBN:9783642624681, 2012.
3. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services

with Microsoft Azure", Packt publishing, 1st Edition, ISBN: 9781784398, 2015.

**OUTCOMES :**

Students who complete this course will be able to

- Validate XML documents with the use of Document Type Definitions and schemas according to industry standards.
- Create web based application with the suitable markup languages.
- Describe the role of web services in various applications.
- Build, integrate and consume web services
- Use SOAP, WSDL & UDDI.
- Construct and deploy web services using the current web technologies.

**CSC X223 BUSINESS PROCESS MANAGEMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- Plan to become business or systems analysts that participate in BPM projects.
- To design the Process Modeling and Process Discovery.
- BPM technology helps organizations become more efficient by coordinating activities.
- To Know about the Qualitative And Quantitative Process Analysis
- To analyze organizational performance from a process perspective, redesign processes using value-focused techniques.
- To design Process Automation and Process Intelligence in BPM systems.

**MODULE I BUSINESS PROCESS ANALYSIS AND DESIGN 07**

Introduction to Business process management- Functional Organization -BPM lifecycle, process modeling - Process Architecture – Introduction to BPM.

**MODULE II PROCESS MODELLING AND PROCESS DISCOVERY 08**

Branching and Merging - Information Artifacts - Processes Decomposition - More on rework and repetition - Handling Events and Exceptions - Discovery method - Process modeling method.

**MODULE III QUALTITATIVE AND QUANTITATIVE PROCESS ANALYSIS 07**

Value -added analysis - Root cause Analysis - Performance Measures - Flow analysis - Queue and Simulation.

**MODULE IV PROCESS REDESIGN 07**

Essence of process redesign - Heuiristic process redesign - The case of heath care institution - Product base design .

**MODULE V PROCESS AUTOMATION 08**

Automation business process - Advantages and challenges of introducing a BPMS - Turning process models Executable

**MODULE VI PROCESS INTELLIGENCE 08**

Process Execution and event logs - Automatic process discovery - Performance Analysis - Conformance Checking

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Dumas, M., La Rosa, M., Mendling, J., Reijers, H,"Fundamentals of Business Process Management" , Springer ,ISBN 978-3-642-33143-8 ,2013.
2. Alexander Grosskopf, Gero Decker, Mathias Weske ,"Business process modeling using BPMN" , Second Edition,Meghan-Kiffer Press,ISBN : 9780929652269, 2009

**OUTCOMES :**

Students who complete this course will be able to

- Analyze and improve Business Processes in organizations.
- Evaluate the Process Discovery and Modeling method.
- Implement the Root Cause Analysis and Flow Analysis of Qualitative Analysis.
- Develop the Process Redesign in BPM.
- To improve their ability in Process Automation and Process Intelligence.
- Evaluate BPMN Process Modules.

| CSC X224 | ADVANCED MACHINE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To teach about deep belief networks.
- To describe the unsupervised machine learning techniques.
- Outline the various semi-supervised learning techniques.
- Comprehend the convolution neural networks.
- To analyze the text feature engineering methods.
- To expose the students to ensemble methods.

**MODULE I** **UNSUPERVISED MACHINE LEARNING AND DEEP BELIEF NETWORKS** **08**

Unsupervised machine learning – Principal component analysis -PCA – a primer - Employing PCA - Introducing k-means clustering -Clustering – a primer - Kick-starting clustering analysis -Tuning your clustering configurations -Self-organizing maps -SOM – a primer -Employing SOM, Deep Belief Networks - Neural networks – a primer -The composition of a neural network -Network topologies - Restricted Boltzmann Machine - Introducing the RBM –Topology –Training - Applications of the RBM - Further applications of the RBM -Deep belief networks -Training a DBN - Applying the DBN - Validating the DBN.

**MODULE II** **STACKED DENOISING AUTOENCODERS AND CONVOLUTIONAL NEURAL NETWORKS** **07**

Stacked Denoising Autoencoders – Autoencoders - Introducing the auto encoder- Topology –Training - Denoising autoencoders - Applying adA - Stacked Denoising Autoencoders - Applying the SdA - Assessing SdA performance , Convolutional Neural Networks -Introducing the CNN - Understanding the convnet topology - Understanding convolution layers - Understanding pooling layers - Training a convent - Putting it all together - Applying a CNN.

**MODULE III** **SEMI-SUPERVISED LEARNING AND TEXT FEATURE ENGINEERING** **08**

Semi-Supervised Learning – Introduction - Understanding semi-supervised learning - Semi-supervised algorithms in action - Self-training - Implementing self-training - Finessing your self-training implementation - Improving the selection process -

Contrastive Pessimistic Likelihood Estimation, Text Feature Engineering –Introduction - Text feature engineering -Cleaning text data - Text cleaning with BeautifulSoup - Managing punctuation and tokenizing - Tagging and categorising words -Tagging with NLTK -Sequential tagging -Backoff tagging -Creating features from text data –Stemming Bagging and random forests -Testing our prepared data.

**MODULE IV FEATURE ENGINEERING PART II 08**

Introduction - Creating a feature set - Engineering features for ML applications - Using rescaling techniques to improve the learnability of features - Creating effective derived variables - Reinterpreting non-numeric features -Using feature selection techniques - Performing feature selection – Correlation – LASSO - Recursive Feature Elimination - Genetic models - Feature engineering in practice - Acquiring data via RESTful APIs - Testing the performance of our model –Twitter -Translink Twitter -Consumer comments -The Bing Traffic API - Deriving and selecting variables using feature engineering techniques -The weather API.

**MODULE V ENSEMBLE METHODS 08**

Introducing ensembles - Understanding averaging ensembles - Using bagging algorithms - Using random forests - Applying boosting methods - Using XGBoost - Using stacking ensembles - Applying ensembles in practice - Using models in dynamic applications - Understanding model robustness - Identifying modeling risk factors - Strategies to managing model robustness.

**MODULE VI ADDITIONAL PYTHON MACHINE LEARNING TOOLS 06**

Alternative development tools -Introduction to Lasagne -Getting to know Lasagne - Introduction to TensorFlow -Getting to know TensorFlow -Using TensorFlow to iteratively improve our models -Knowing when to use these libraries.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. By John D. Kelleher, Brian Mac Namee and Aoife D'Arcy, “Fundamentals of Machine Learning for Predictive Data Analytics”, MIT Press, 1st Edition, ISBN: 9780262029445. 2015.
2. Amouzegar, Mahyar (Ed.), “Advances in Machine Learning and Data Analysis”, Springer, 1st Edition, ISBN 978-90-481-3176-1, 2010.
3. Koronacki, Jacek, Ras, Zbigniew W, Wierzchon, Slawomir T. ,“Advances in Machine Learning II” , Springer, 1st Edition, ISBN 978-3-642-05178-4, 2010.

4. John Hearty, “Advanced Machine Learning with Python”, PACKT publishing limited, Kindle Edition, ISBN-13: 978-1784398637, 2016.
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2nd Edition, ISBN-10: 0-387-31073-8, 2006.

**OUTCOMES :**

Students who complete this course will be able to

- Recall the semi-supervised learning techniques.
- Describe the unsupervised learning techniques.
- Improve the effectiveness of your deep learning models further by using powerful ensembling techniques to strap multiple models together.
- Automate large sets of complex data and overcome time-consuming practical challenges.
- Develop the accuracy of models and existing input data using powerful feature engineering techniques.
- Use multiple learning techniques to improve the consistency of results.

**Elective 2**

| CSC X228 | INFORMATION VISUALIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 1 | 0 | 3 |

**OBJECTIVES :**

- To lay the foundation for visualization of data.
- To understand the features of visualization and impact of using colours.
- To appraise visual attention and categorize texture handling.
- To devise visualization techniques to represent static and dynamic patterns.
- To deduce visual objects space perception.
- To formulate the visualization strategies for information presentation.

**MODULE I SCIENCE OF DATA VISUALIZATION 08**

Visualization stages, semiotics based on perception, Model of perceptual processing, Types of data, Environment, Optics, Resolution, and Display.

**MODULE II LIGHTNESS, BRIGHTNESS, CONTRAST, AND CONSTANCY 07**

Neurons, Receptive Fields, and Brightness Illusions, Luminance, Brightness, Lightness, and Gamma, Color Measurement, CIE System of Color Standards, Opponent Process Theory, Color Appearance.

**MODULE III VISUAL ATTENTION AND INFORMATION 08**

Searching the Visual Field, Preattentive Processing, Rapid Area Judgments, Coding with Combinations of Features, Conjunctions with Spatial Dimensions, Gabor Model and Texture in Visualization, Texture Coding Information, Glyphs and Multivariate Discrete Data.

**MODULE IV STATIC AND MOVING PATTERNS 07**

Gestalt Laws, Contours, Perception of Transparency, Perceptual Syntax of Diagrams, Patterns in Motion.

**MODULE V VISUAL OBJECTS SPACE PERCEPTION 07**

Image-Based Object Recognition, Structure-Based Object Recognition, Perceiving the Surface Shapes of Objects, Depth Cue Theory, Task-Based Space Perception.

**MODULE IV INTERACTING WITH VISUALIZATIONS AND THINKING WITH VISUALIZATION** **08**

Data Selection and Manipulation Loop, Exploration and Navigation Loop, Memory Systems, Eye Movements, Problem Solving with Visualizations, Implications for Interactive Visualization Design, Interfaces to Knowledge Structures.

**L – 30; T – 15; TOTAL HOURS-45**

**REFERENCES :**

1. Colin Ware, “Information Visualization : Perception for Design”, Morgan Kaufmann, an imprint of Elsevier, Third edition, ISBN-13: 978-0123814647, 2012.
2. Robert Spence, “Information Visualization: Design for Interaction”, Pearson Publishers, Second Edition, ISBN-13: 978-0132065504, 2007.
3. Andreas Kerren, John Stasko, Jean-Daniel Fekete and Chris North, “Information Visualization: Human-Centered Issues and Perspectives (Lecture Notes in Computer Science)”, Springer edition, ISBN-13: 978-3540709558, 2008.

**OUTCOMES :**

Students who complete this course will be able to

- Acquire skills for visualization of data.
- Assess the features of visualization and handling of colours in visualization.
- Recognize various visual attention strategies and apply according to the given scenario,
- To analyze and propose appropriate visyualization techniques for static and dynamic patterns.
- To construct visual object space perception.
- To devise visualization strategies for presentation of real time scenarios

**CSC X229** **CYBER FORENSICS** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To inculcate the fundamentals of digital forensics from the viewpoint of courtroom legalities.
- To introduce the different types of cyber crimes.
- To begin the policies and procedures to investigate cyber crime.
- To create forensics concepts and practices focusing on networks and internet.
- To gain the knowledge on digital investigations.
- To explore the current techniques and tools for forensic examinations.

**MODULE I FORENSICS FUNDAMENTALS 7**

Introduction-Law Enforcement – Services- Benefits of Professional Forensics Methodology – Types of computer forensics technology.

**MODULE II FORENSICS SYSTEM & SERVICES 8**

Internet Security Systems – Intrusion Detection System – Firewall Security System – Storage area network security systems – Network disaster Recovery System – Satellite Encryption Systems – Fighting Cyber Crime with Risk Management Techniques- Computer Forensics Investigation Services – Forensics Process Improvement.

**MODULE III DATA RECOVERY 8**

Live data collection – Forensics Duplication – Collecting Network based Evidence – Evidence Handling – Hiding and Recovering Hidden Data – Data backup and Recovery

**MODULE IV EVIDENCE COLLECTION & DATA SEIZURE 7**

Collection Options – Types of Evidence – Rules of Evidence – Volatile Evidence – Collection& Archiving – Methods of Collection – Artifacts – Collection Steps – Reconstructing the Attack.

**MODULE V DATA ANALYSIS 8**

Computer System Storage Fundamentals – Data analysis techniques – Analyzing network traffic – Investigating hacker Tool –Investigating Routers – Writing Computer Forensics Reports.

**MODULE VI COMPUTER AND DIGITAL FORENSICS 7**

Types of cyber crime -Credit card and cyber crime-Web hacking - Digital Detective Work-Cell Phone Forensics - Email and Webmail Forensics - Cyber laws of different countries.

**L-45;TOTAL HOURS-45**

**REFERENCES :**

1. John Sammons, “The Basics of Digital Forensics, The Primer for Getting Started in Digital Forensics”, Elsevier, 2nd Edition, ISBN: 9781597496612, 2014.
2. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet“, Published by Elsevier, 3rd Edition , ISBN:9780123742681, 2011.

**OUTCOMES :**

Students who complete this course will be able to

- Analyze the digital and cyber forensics policies and procedures.
- Apply the hacking techniques to secure the Applications.
- Identify the legal and ethical issues surrounding cyber crime and forensics.
- Assess digital evidence and practice forensic investigation.
- Express the legalities, penalties, and punishment associated with cyber.
- Identify the current techniques and tools for forensic examinations.

| CSC X230 | SMART DEVICES SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- Instigate with protecting a mobile device from security threats
- To discuss how iOS is secured and hack the iPhones
- To showcase the different security model of Android and iPhone
- To converse the different attacks and information leakage in Android phone
- To gain the knowledge of general web service security and mobile web browser
- To know the mobile development security and mobile payment

**MODULE I** **MOBILE RISK ECOSYSTEM AND HACKING THE CELLULAR NETWORK – iOS - ANDROID** **07**

The Mobile risk ecosystem, the mobile ecosystem, the mobile risk model, hacking the cellular network, attacks and countermeasures- iOS: how secure is iOS, jailbreaking, hacking other iPhones - Android: Security Model, rooting, Intent based attacks, NFC-based attacks, information leakage.

**MODULE II** **MOBILE MALWARE AND MOBILE SERVICES AND MOBILE WEB** **08**

Mobile malware: Android malware, iOS malware, Malware Security: Android vs. iOS. Mobile services and Mobile web: General web service security guidelines, mobile web browser and web view security.

**L-15;TOTAL HOURS-15**

**REFERENCES :**

1. Neil Bergman, Mike Stanfield , Jason Rouse & Joel Scambray , “Hacking Exposed :Mobile Security Secrets & Solutions “, McGraw Hill, ISBN: 978-0-07-181702-8, 2013.
2. Rich Campagna, Subbu Iyer, Ashwin Krishnan, Mark Bauhaus,“Mobile Device Security For Dummies”,Wiley Publication, ISBN: 978-1-118-09380-1, July 2011.
3. Mike Oliver, Sybase ,”Mobile Device Management for Dummies”, , John wiley & Sons Ltd., ISBN: 978-0-470-69472-5, 2011.
4. Georgina Gilmore & Peter Beardmore ,“Mobile Security & BYOD for Dummies”, Wiley Brand, ISBN:978-1-118-66242-7,2012.

**OUTCOMES :**

Students who complete this course will be able to

- Point out the physical risk, service risk and app risk in mobile
- Identify the different malware, phishing, virus, worms in mobile
- Make out the security model for Android and iPhone
- Discover the Android and iPhone malware and provide the malware security
- Develop Mobile Device Management to secure the mobile.
- Gain the knowledge in mobile development security and mobile payment

**CSC X231 BIOMETRIC SECURITY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To provide students with understanding of biometrics, biometric equipment and standards applied to security.
- To learn the fundamental issues and technologies for Biometric security.
- To Recognize physical and behavior biometric characteristics.
- To illustrate the key issues and importance of biometric systems for security concerns.
- To discuss the biometric computing knowledge and methods.
- To learn some basic biometrics systems with real case studies.

**MODULE I INTRODUCTION TO BIOMETRICS 08**

Cancelable Biometrics and Data Separation Schemes-Minutiae based Finger print representations-reviews-privacy-security and cryptography realization-palmprint template protection technologies.

**MODULE II BIOMETRIC KEY AND ENCRYPTION 08**

Biometric Discretization for Template Protection and Cryptographic key generation-De Identifying Biometrics Images –Decomposition-Mixing

**MODULE III BIOMETRIC SYSTEM ANALYSIS 08**

BioPACE:Biometric Protected Authentication Connection Establishment-Privacy and security assessment of biometric systems-A generalized framework for privacy and security assessment of biometric Template Protection.

**MODULE IV PRIVACY ENHANCED BIOMETRIC SYSTEMS 07**

Secure and Efficient Iris Fingerprint Identification-Security over Outsourced Biometric Data.

**MODULE V BIOMETRIC IDENTIFICATION AND AUTHENTICATION 07**

A Collaborative Framework Design for Distributed Biometrics based Authentication in cloud-Secure Two party Computation and Biometric Identification.

**MODULE VI BIOMETRIC SECURITY TECHNOLOGIES 07**

Other Biometric security Technologies-Watermarked Biometrics-3D Fingerprints – case studies

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. David Chek Ling Ngo, Andrew Beng Jin Teoh, Jiankun Hu, “Biometric Security”Cambridge scholars publishing,1st Edition,2015.
2. Richard Jiang, Somaya Al-Madeed, Ahmed Bouridane, Danny Crookes, Azeddine Beghdadi,” Biometric Security and Privacy:”,Springer,1st Edition,2017.

**OUTCOMES :**

Students who complete this course will be able to

- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
- Understand and analyze biometric systems at the component level.
- Analyze and design basic biometric system applications.
- Be able to work effectively in teams and express their work and ideas orally and in writing.
- Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
- Understand various Biometric security issues.

**CSC X232 DATABASE SECURITY L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To expose the need for Database security in real time systems.
- To compare the architecture model of several Database Management systems.
- To describe database security architecture and password policies.
- To infer the impact of SQL injection in database systems.
- To focus on various auditing and security procedures for Database systems.
- To overview fundamental concepts of multilevel relational databases and its security models.

**MODULE I INTRODUCTION 08**

Security and Information technology - Database security – Security Architecture – Operating system Security fundamentals.

**MODULE II DATABASE (DB) REVIEW 08**

DB Definition –DB Structure components –DB Models – DB Relationships – DB types – DB Management systems – DB similarities – Oracle Architecture – MySQL Architecture – Microsoft SQL Server Architecture

**MODULE III PASSWORD, PROFILES, PRIVILEGES AND ROLES 08**

Defining and Using Profiles – Designing and Implementing Password Policies - Granting and Revoking User privileges – Creating, Assigning and Revoking User Roles.

**MODULE IV SQL INJECTION 08**

Identification – Understanding SQL Injection – Identifying vulnerabilities – Exploitation and Defense – Exploitation and Information gathering – Extracting the Red Data – Exploitation of Privileges and passwords – Defending against Exploitation.

**MODULE V SECURITY AUDITING AND TESTING 07**

Virtual private Databases - Database Auditing Models - Auditing Database Activities – Security Testing – Testing Methodology – Case study.

**MODULE VI MULTILEVEL DATABASE SECURITY 06**

Introduction - Multilevel Database Relations - Polyinstantiation - Multilevel Database

Security Models – Concurrency control - Performance Study .

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Alfred Basta , Melissa Zgola, “Database Security”, Delmar Cengage Learning,1st Edition, ISBN : 9781435453906, 2011.
2. Hassan A. Afyouni, “Database Security and Auditing: Protecting Data Integrity and Accessibility”, Cengage India; 1 edition, ISBN-13: 978-8131519059, 2013.
3. Osama S. Faragallah, El-Sayed M. El-Rabaie, Fathi E. Abd El-Samie, Ahmed I. Sallam, Hala S. El-Sayed,” Multilevel Security for Relational Databases”, Auerbach Publications, ISBN 9781482205398, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Define the basics of Database management systems.
- Compare and contrast different Database security architecture.
- Analyze the impact of SQL injection attacks and its remedies
- Design secured Database User profiles and provides solutions to overcome password and privilege exploitation.
- Apply different security testing methodology and audit the Database activities in real time environment.
- Relate different multilevel database security models and design in real time environment.

| CSC X233 | SOFTWARE QUALITY ASSURANCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To provide an in depth understanding of software quality management process.
- To introduce concepts, metrics, and models in software quality assurance
- To describe the process and product quality attributes.
- To highlight the various activities of quality assurance, types of reviews and audits.
- To investigate the expectations of software quality in projects.
- To provide an overview of software quality standards.

**MODULE I QUALITY ASSURANCE BASICS 07**

Quality and Reliability – Evolution of the concepts of Quality – Quality gurus – Total Quality Management – Costs of Quality - Quality in organizations – Quality goals – Current scenario in software development organizations.

**MODULE II SOFTWARE QUALITY DIMENSIONS 08**

Four Dimensions of Software Quality – Specification – Conformance – Design – Development – Ensuring Quality -Software Product Quality – Measurement of software quality

**MODULE III VERIFICATION AND VALIDATION 07**

Verification – Walkthroughs – Inspections – Audits – Verification Process-Implementation of Verification activities in projects – Validation of Software Design – Specification – Product Validation

**MODULE IV PRODUCT AND PROCESS QUALITY 08**

Software Product Quality - Process Quality – Improvement and Stabilization – Process Models - Components of a Process - Metrics for Software Quality –Process and Product Metrics.

**MODULE V NEW PARADIGMS OF SOFTWARE QUALITY 07**

Current Certification Paradigms-Fallacy of Certifications – Maturity Models – New Paradigms for Software Quality Assurance.

**MODULE VI SOFTWARE QUALITY STANDARDS 08**

Quality management standards – ISO 9001 and 9000-3 – CMMI – SPICE- Tools for Quality improvement- Quality Control Tools.

**L – 45; TOTAL HOURS-45**

**REFERENCES :**


1. Murali Chemuturi, “Mastering Software Quality Assurance: Best Practices, Tools and Techniques “, J.Ross Publishing, ISBN-978-1-60427-032-7., 2011.
2. Daniel Galin, “Software Quality Assurance: From Theory to Implementation” - Addison-Wesley, ISBN 0201709457, 2004.
3. 1.
4. Ivan Mistrik , Richard M Soley ,Nour Ali , John Grundy , Bedir Tekinerdogan “Software Quality Assurance: In Large Scale and Complex Software-intensive Systems “,Morgan Kaufmann, ISBN – 0128023015,2015.
5. Abu Sayed Mahfuz, Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, ISBN 149873555X, 9781498735551, 2016.
6. Schulmeyer, G. Gordon and McManus, James, Handbook of Software Quality Assurance, 3rd Ed. Prentice Hall, 2008.


**OUTCOMES :**

Students who complete this course will be able to

- Define software quality and describe the role of quality assurance in the software development process.
- Describe the quality of specifications, design, construction and conformance as applicable to software development organizations.
- Compare the various quality reviews and audits.
- Assess the quality and reliability of software products and compare software quality metrics.
- Explore the quality of the process from an implementation point of view and apply new paradigms for quality assurance.
- Demonstrate quality assurance tools and explore standards and techniques.

**CSC X234 CUSTOMER RELATIONSHIP MANAGEMENT L T P C**
**1 0 0 1**

**OBJECTIVES :**

- To understand your role in achieving good customer relationship management with a customer and/or stakeholders.
- To be aware of the key skills needed to carry out successful customer relationship management, in order to build more productive & mutually rewarding relationships with customers and/or stakeholders.
- To be able to identify and respond to customers & stakeholders needs, expectations & issues that both meet their needs and protects the interests of your organization.
- To learn the skills to communicate with and influence customers & stakeholders
- To study simple CRM techniques
- To concentrate on customers to build long lasting relationships that allow to beat the competition.

**MODULE I DEFINING CRM 06**

New Spin on Customer Loyalty – CRM and customer Service – CRM in e-Business – Analytical CRM

**MODULE II DELIVERING CRM 09**

Defining and Preparing the CRM business plan – Choosing a CRM tool – CRM Implementation

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Kyle booth, “The Customer Relationship Management Handbook - Everything You Need to Know about Customer Relationship Management , History Ink Books, Illustrated Edition, ISBN: 9781489123251,2016.
2. Jill Dyche, “CRM Handbook, The: A Business Guide to Customer Relationship Management” ,Addison Wesley Publishers,1st Edition, ISBN: 9780201730623 ,2002.
3. Paul Green Berg, “CRM at the Speed of Light” , Tata McGrawHill,4th Edition, ISBN: 9780071590457,2010.
4. Scott Kostojohn, Mathew Johnson, Brian Paulen, “ CRM Fundamentals”,Apress Publishers, 1st Edition, ISBN: 9781430235903,2011.

**OUTCOMES :**

Students who complete this course will be able to

- Critically review and interpret the theoretical aspects of CRM across the main areas of e-business.
- Provide an insight into the concepts and strategic implementation of CRM.
- In-depth understanding of the benefits of CRM and the competitive advantage this methodology provides.
- Insight on the challenges and constraints organizations face in attempting to incorporate CRM.
- Analyze how technology can be leveraged to enhance a CRM initiative.
- Assess the best practices in multiple vertical markets.

| CSC X235 | SERVICE ORIENTED ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To lay the foundation on principles and characteristics of service oriented architecture.
- To learn the importance of SOA in Application Integration
- To explore SOA, Service-Orientation and service composition.
- To provide knowledge on service Technology.
- To understand and design the SOA based solutions.
- To learn service oriented design process.
-

**MODULE I SOA BASICS 10**

An Overview of SOA & Service-Orientation - Applying Service-Orientation - Principles of Service-Orientation - Characteristics of SOA - Types of SOA - SOA Design Patterns - Goals of Applying Service-Orientation - Planning for and Governing SOA - Pillars of Service-Orientation - Seven Levels of Organizational Maturity

**MODULE II SERVICE COMPOSITION 10**

Basic Concepts - Service Models and Service Layers - Service and Service Capability Candidates - Breaking down the business problem - Functional decomposition - Service encapsulation - Agnostic Context - Non-Agnostic Context - Process Abstraction and Task Services - Building Up the Service-Oriented Solution - Service Composition

**MODULE III SERVICE TECHNOLOGY 10**

An Overview of Service Technology - Web-Based Services - SOAP-Based Web Services - REST Services - Components - Service Virtualization - Cloud Computing - Semantic Web - Business Process Management - Social Network Technologies - Mobile Computing - Agent-Driven Architecture - Business Intelligence - Big Data - Service-Driven Industry Models - The Enterprise Service Model - The Virtual Enterprise Model - Case Study

**L – 30; TOTAL HOURS-30**

**REFERENCES :**

1. Thomas Erl, “Service-Oriented Architecture: Analysis and Design for Services and Microservices”, PHS Series, 2nd Edition, ISBN : 9780133858587, 2017
2. Thomas Erl, Pethuru Chelliah, Clive Gee, Jürgen Kress, Berthold Maier, Hajo

Normann, Leo Shuster, Bernd Trops, Clemens Utschig, Philip Wik, Torsten Winterberg, “Next Generation SOA: A Concise Introduction to Service Technology & Service-Orientation”, PHS Series, 1st Edition, ISBN : 9780133859041, 2015

3. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,“ Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World”, Springer, 2nd Edition, ISBN:9783642624681, 2012.
4. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services with Microsoft Azure”, Packt publishing, 1st edition, ISBN: 9781784398, 2015.

**OUTCOMES :**

Students who complete this course will be able to

- Describe the Service Orientation principles and business modeling.
- Explore the underlying technology for service design.
- Develop design standards for SOA - based solutions.
- Identify different service technologies and critique upon them.
- Develop the Web services using current technologies.
- Apply SOA concepts to real world problems.

**CSC X236** **GENETIC ALGORITHM** **L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To familiarize with Mathematical foundations for Genetic algorithm operators.
- To study the Applications of Genetic Algorithms.
- To understand filtering techniques and their broad applicability to a range of optimization problems.
- To emphasize the importance of optimization in engineering activities.
- To provide a broad introduction to the field of Genetic Algorithms and other fields of hierarchical genetic algorithm.
- To teach students how to apply these methods to solve problems in complex domains.

**MODULE I INTRODUCTION 08**

Chromosome Representation-Objective and Fitness Functions-Selection Methods-Genetic Operators-Intrinsic characteristics-Parallel Genetic algorithm-Multiple objective-Robustness-Multimodel-constraints

**MODULE II FILTERING AND H-INFINITY CONTROL 08**

Digital IIR Filter Design –Chromosome coding-The Lowest Filter Order Criterion -Time Delay Estimation-Active Noise Control-A Mixed Design Approach-The Distillation Column Design-Bench mark problem.

**MODULE III HIERARCHICAL GENETIC ALGORITHM 07**

Biological Inspiration-Hierarchical Chromosome Formulation-Genetic Operations-Multiple Objective approach-Neural Networks-Fuzzy Logic

**MODULE IV SPEECH RECOGNITION SYSTEMS 08**

Back ground of Speech Recognition systems-Dynamic Time Warping-Genetic Time Warping algorithm-Cross over-Mutation-Hidden Markov model-A Multiprocessor system for parallel Genetic Algorithms

**MODULE V GENETIC ALGORITHMS IN PLANNING AND SCHEDULING PROBLEMS 07**

ETPSPS scheme-Bottle neck analysis-selection key process-operational parameters for GA cycles-GA applications for ETPSP

**MODULE VI GENETIC ALGORITHMS IN COMMUNICATION SYSTEMS 07**

Virtual path design in ATM-Problem formulation-Combination approach-Design of mesh communication networks-Network optimization using GA-Wireless local area network design

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Kim-Fung Man, Kit Sang TANG, Sam Kwong,"Genetic Algorithms: Concepts and Designs", Springer,4th Edition,ISBN:9781852330729,2012.
2. Michael Mutingi, Charles Mbohwa ,"Grouping Genetic Algorithms: Advances and Applications",Springer,1st Edition ,ISBN:9783319443942,2017.

**OUTCOMES :**

Students who complete this course will be able to

- Appreciate the use of various GA operators In solving different types of GA problems.
- Understand and appreciate the basic concepts of Genetic algorithms in communication systems.
- Creating an understanding about the way the GA is used and the domain of application.
- Formulate a problem as a hierarchical approach by specifying representations, selection and variation operators.
- Write a program or use a package to implement the speech recognition systems.
- Apply genetic algorithms to planning and scheduling problems.

**CSC X237 ENTERPRISE RESOURCE PLANNING L T P C**

**2 1 0 3**

**OBJECTIVES :**

- To gain knowledge on the challenges of ERP in Business.
- To introduce various ERP Products.
- To acquire knowledge on the various core process analysis activities.
- To learn the various issues relating to customization and testing
- To illustrate the accounting process in ERP systems
- To have an overview of the fundamentals of process modeling and ERP implementation

**MODULE I INTRODUCTION 06**

ERP as a Business Enabler– Evolution of ERP – ERP Life Cycle – ERP Products– Open-Source ERP- Project Initiation- Case Study

**MODULE II CORE PROCESS ANALYSIS 07**

Business Requirement Definition- Prerequisites- Activities- Deliverables– Decision Matrix – Conference Room Pilot– Business Flow Diagram- Install the CRP Instance.

**MODULE III CUSTOMIZATION 08**

Process Flow Diagram , Gap Analysis, Design , Interface and Conversion, Implementation Schedule— Interface Development– Interface Integration Testing – Validate Backlog Transaction Data.

**MODULE IV SYSTEM INTEGRATION TESTING AND TRAINING 08**

Implementation Schedule—System and Regression Testing- Prepare Testing Environment – Task List for Training- Develop Training/User Procedures Strategy - End User Documentation.

**MODULE V ACCOUNTING IN ERP SYSTEMS 08**

Operational Decision-Making Problem- Product Profitability Analysis- Management Reporting with ERP Systems- Human Resources Processes with ERP

**MODULE VI ERP IN BUSINESS SCHOOL 08**

Project Management Life Cycle – Risk Management – Problem Management – Problem

Reporting and Escalation- Methodology – Case Study XIMB.- Process Modeling, Process Improvement, and ERP Implementation

**L – 30; T – 15;TOTAL HOURS-45**

**REFERENCES :**

1. Ganesh, K., Mohapatra, S., Anbuudayasankar, S.P. and Sivakumar, P., "Enterprise Resource Planning-Fundamentals of Design and Implementation", Springer International Publishing, 1st Edition, ISBN: 978-3-319-05927-3, 2014.
2. Ellen F. Monk and Bret J. Wagner, " Concepts In Enterprise Resource Planning ", Course Technology, Cengage Learning, 4th Edition, ISBN: 978-1-111-82039-8, 2013.
3. Lineke Sneller RC, "A Guide to ERP-benefits,implementation and trends", Bookboon Publication, 1st Edition, ISBN: 9788740307290, 2014.

**OUTCOMES :**

Students who complete this course will be able to

- Define the terminology, features, and characteristics embodied in ERP
- Apply the principles behind ERP to design real time applications.
- Comprehend the analysis and activities of the business process chosen
- Acquire practical competence in the usage and application of tools to support ERP in B school
- Adopt different accounting process for designing a ERP system.
- Compare the functioning of various ERP Implementations.

**CSC X238** **API DESIGN** **L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To analyze the background and objectives of the API Specification.
- API fundamentals, including the business and technical cases for building and consuming web-based APIs.
- Recognize the Quality Management Principles.
- Understand the process approach for effective API design.
- Acquire the requirements and implementation steps of the API Specification.
- Learn the API Specification Certification process.

**MODULE I CREATE AN API** **10**

Distributed Development -Modularizing Applications -Nonlinear Versioning - Communication -Empirical Programming- Method and Field Signatures-Files and Their Content-Environment Variables and Command-Line Options-Text Messages As APIs-Protocols-Behavior - Comprehensibility –Consistency-Discoverability - Life Cycle of an API

**MODULE II API DESIGN** **10**

A Method -A Factory Is Better Than a Constructor-Allow Access Only from Friend Code Removing a Method or a Field -Removing or Adding a Class or an Interface-Inserting an Interface or a Class into an Existing Hierarchy-Adding a Method or a Field - Types of Modular Design-Intercomponent Lookup and Communication.

**MODULE III API SECURITY AND USER MANAGEMENT** **10**

User Management-Identification-Authentication-Usernames and Passwords-Session-Based Authentication-Other Authentication Methods-Fortify Authentication with SSL-Encryption-Threat Detection and Prevention-SQL Injection-XML and JSON Attacks-Data Masking-General Recommendations-API Data Protection Recommendations-API Security Recommendations

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Jaroslav Tulach," Practical API Design: Confessions of a Java Framework Architect" ISBN=1430243171, 2012
2. Daniel Jacobson, Greg Brail, Dan Woods," APIs: A Strategy Guide",

ISBN=1449308929, 2011

3. Jason Paul Michel “Web Service APIs and Libraries”, ISBN= 978-0838911822,2013

**OUTCOMES :**

Students who complete this course will be able to

- Translate design requirements into API resources and methods.
- Use API Design process to create API definitions.
- Use RAML to define API resources, methods, parameters, and responses.
- Create document for API processing and test APIs.
- Minimize repetition in API definitions using resource types and traits.
- Model data in APIs using data types.

**SEMESTER VII**

**Programme Elective ##4**

**Elective 1**

| | | | | | | |
|---|---|---|---|---|---|---|
| **CSC X143** | **DEEP LEARNING** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

**OBJECTIVES :**

- To learn the machine learning basics
- To estimate the deep learning networks
- To describe the deep networks.
- To expose the students to sequence modeling
- To appraise the recent advances in deep learning.
- To summarize the practical methodology and applications of deep learning.

**MODULE I MACHINE LEARNING BASICS FOR DEEP LEARNING 08**

Learning Algorithms - Capacity, Overfitting and Underfitting -Hyper parameters and Validation Sets - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating Deep Learning.

**MODULE II DEEP LEARNING NETWORKS 07**

Introduction – Historical context of Deep Learning – Classes of Deep Learning Network – Deep Networks for Unsupervised learning – Deep Networks for Supervised learning – Hybrid Deep Networks.

**MODULE III DEEP NETWORKS: MODERN PRACTICES 08**

Deep Feedforward Networks - Architecture Design - Back-Propagation and Other Differentiation Algorithms - Regularization for Deep Learning - Regularization and Under- Constrained Problems - Optimization for Training Deep Models - Optimization Strategies and Meta-Algorithms – Convolutional Network.

**MODULE IV SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS 08**

Unfolding Computational Graphs - Recurrent Neural Networks - Deep Recurrent Networks - The Challenge of Long-Term Dependencies - Echo State Networks - The Long Short-Term Memory and Other Gated RNNs - Optimization for Long-Term Dependencies.

**MODULE V PRACTICAL METHODOLOGY AND APPLICATION 07**

Performance Metrics - Default Baseline Models - Selecting Hyperparameters - Debugging Strategies - Example: Multi-Digit Number Recognition – Applications - Computer Vision, Speech Recognition and Natural Language Processing – Other Applications.

**MODULE VI RESNET 07**

Review of Deep Learning-Problems in Deep Learning- Deep Learning Architecture - Deep Rezidual Learning-Application of ResNet-Case Study.

**L – 30; P – 30;TOTAL HOURS-60**

**REFERENCES :**

1. Li Deng and Dong Yu, “Deep Learning Methods and Applications”, Now Publisher, 1st Edition, ISBN: 1932-8346, 2014.
2. Josh Patterson, Adam Gibson, “Deep Learning”, O'Reilly Media, 1st Edition, ISBN: 978-1491914250, 2017.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 1st Edition, ISBN: 978-0262035613, 2017.
4. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 1stEdition, ISBN: 978-1259096952, 2013.
5. LaureneFausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Pearson, 1st Edition, ISBN- 978-8131700532, 2004.

**OUTCOMES :**

Students who complete this course will be able to

- Illustrate the machine language applications in deep learning
- Identify the various deep learning algorithms and its application
- Evaluate the role of sequence modeling
- Compare the various deep learning network algorithms
- Apply the deep learning algorithms to solve real time problems.
- Acquire skills in handling situations involving application of deep learning

**CSC X144 INTRUSION DETECTION & PREVENTION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To study the fundamental concepts in Intrusion detection
- To discuss about the various Intrusion detection networks.
- To expose to the advanced detection Methods
- To gain knowledge on Intrusion prevention system
- To train how to choose the appropriate algorithm for designing intrusion detection networks.
- To expose the students to various detection approaches.

**MODULE I INTRODUCTION 05**

Cyber intrusion – Malware- Intrusion detection system – Intrusion detection networks– co-operation technologies and algorithms.

**MODULE II DESIGN OF AN INTRUSION DETECTION NETWORKS 08**

Network Architecture design – Collaboration framework – Trust management – Robustness against common treats – simulations and experimental results.

**MODULE III WIRELESS INTRUSION DETECTION SYSTEMS 08**

Architecture – Data Collection – Intrusion Detection- Detection Methods - Correlation techniques –Evaluation

**MODULE IV INTRUSION DETECTION AND PREVENTION SYSTEMS 08**

Host-based Intrusion Detection System – Network-Based Intrusion Detection System (IDS) / Intrusion Prevention System (IPS)- Signature-Based Detection-IDS/IPS System Architecture and Framework-Responses by IDPS to the Intrusions

**MODULE V DETECTION APPROACHES 08**

Anomaly Detection – Data Collection for Host-Based IDSs – Theoretical Foundation of Detection – Intrusion Response-. Examples of Commercial and Open Source IDSs

**MODULE VI OTHER TYPES OF IDN DESIGN 08**

Intrusion detection rules and alerts– knowledge based Intrusion detection networks –

Bayesian learning and dynamic algorithm – collaborative malware detection network – decision model – evaluations.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**


1. Carol Fung and Raouf Boutaba, “Intrusion Detection Networks: A Key to Collaborative Security”, CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1466564121, 2014.
2. Gorbani A.A, Lu w Tavallaee M “Network Intrusion Detection and Prevention-concepts and techniques”, Springer International Publishing, 1st Edition, ISBN: 9780387887708, 2010.
3. Al-Sakib Khan Pathan, “The State of the Art in Intrusion Prevention and Detection”, CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1-4822-0351-6, 2014.
4. Umesh Hodeghatta Rao and Umesha Nayak, “The Infosec Handbook: An introduction to Information Security”, APress, 1st Edition, ISBN: 978-1430263821, 2014.


**OUTCOMES :**

Students who complete this course will be able to

- Apply the architecture design of various Intrusion detection networks to solve real time applications
- Design, conduct simulations and provide experimental results of detection algorithms
- Identify the needs of Intrusion detection networks
- Adopt advanced detection Methods for solving research problems
- Comprehend the quality attributes of intrusion detection and prevention algorithms.
- Compare the functioning of various detection approaches.

**CSC X145 SECURITY LAW AND COMPLIANCE**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To understand how to apply the principles of information security management in a variety of contexts.
- To equip students with the analytical skills and tools to address technology law issues.
- To learn the techniques and prove their compliance.
- To understand the main drivers forcing companies to look into Governance, Risk management, Compliance and Information Security solutions.
- To create a security awareness and manage the security laws
- To implement practical steps to cope with technology law risk.

**MODULE I MANAGING SECURITY 10**

Creating a Security program – Asset Management and Documentation – Policies – Standards and Procedures

**MODULE II SECURITY LAW 10**

Security – World of Securities Law – Business Context of Securities Law – How Securities are registered under the securities act

**MODULE III MANAGEMENT ISSUES 10**

IT Security Controls plans - Bottom of Form And procedures – Security Awareness, Training and Education – Security auditing – Legal and Ethical aspects

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Lee Brotherston, Amanda Berlin, “Defensive Security Handbook”, O’Reilly publishers, 1st Edition, ISBN: 978-1491960387, 2017.
2. Larry Soderquist &Theresa Gobaldon, “Security Law”, Foundation Press, 5th Edition, ISBN:9781609304690, 2014.
3. William Stallings & Lawrie Brown, “Computer Security Principles and Practice, Pearson Education, 3rd Edition, ISBN: 9780133773927, 2015.

**OUTCOMES :**

Students who complete this course will be able to

- Evaluate technologies, such as digital signatures, to comply with the law and serve as evidence.
- Appreciate current and imminent legislation pertinent to ICT governance, risk management and compliance.
- Make decisions about the law of data security and investigations.
- Identify the Interrelationship between the various elements of information security management and its role in protecting organizations.
- Demonstrate work in compliance with established standards and relevant legislation in the protection, security and investigation fields.
- Assign and evaluate delegated duties and responsibilities in compliance with organizational policies and procedures.

**CSC X146 SOFTWARE DESIGN PATTERNS L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To explain what specific object oriented design problem the pattern solves.
- To provide a specific context for each pattern in which it can be applied.
- To draw a high level class diagram in UML for each pattern.
- To list the consequences of applying each pattern to the overall software quality
- of a system.
- To study the different types of patterns.
- To implement this pattern to a real world problem.

**MODULE I OVERVIEW 06**

Essential Elements of design patterns- Catalog of design patterns- Common themes in structural patterns- How to select and use a design pattern-How design pattern solve design problems

**MODULE II CATEGORIES OF DESIGN PATTERNS 09**

Creational patterns - Structure patterns- Behavior patterns- Anti-patterns

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Erich Gamma, Richard Helm, Ralph Johnson & John Vlissidess, “Design Patterns: elements of Reusable Object Oriented Software”, Pearson Education, 2nd Edition, ISBN: 9789332555402, 2015.
2. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, “Head First Design Patterns: A Brain-Friendly Guide”, Shroff Publishers & Distributors Pvt. Ltd., 10th Edition, ISBN: 9789352132775,2014.
3. Kerievsky, “Refactoring to Patterns”, Pearson Education, 1st Edition, ISBN: 9780321213358, 2004.

**OUTCOMES :**

Students who complete this course will be able to

- Recognize the architecture, creating it and moving from one to any, different structural patterns.
- Analyze the architecture and build the system from the components.
- Design creational and structural patterns.

- Demonstrate what tradeoffs need to be made when implementing a design pattern.
- Mix patterns with each other and understand the consequences of mixing patterns on the overall quality of a system.
- Know what design pattern to apply to a specific problem.

**CSC X147 WRITING SKILLS FOR ENGINEERING LEADERS**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To addresses the specific combination of thinking and writing skills needed to succeed in modern engineering.
- To describe how to avoid logical fallacies and use physical reasoning to catch mistakes in claims.
- To covers the essentials of technical grammar and style as well as the elements of mathematical exposition.
- To emphasizes the centrality of the target audience, and thus the need for clear and concise prose.
- To check for spelling, word choice, sentence structure, punctuation, paragraph and essay writing
- To learn the basics of English writing with its clear, concise concept explanations and useful, relevant corresponding exercise.

**MODULE I WRITING BY DESIGN 07**

Clearly understand the goal – Mindset for Technical writing – Avoid the worst thinking traps- Grammar and style.

**MODULE II WRITING SKILLS 08**

Basic Structure – The Paragraph – The Essay – Writing skills – Organizing ideas- Choosing quotations- Writing arguments and summaries – Revising and presenting work.

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Len Bass Edward J. Rothwell, Michael J. Cloud," Engineering Writing by Design: Creating Formal Documents of Lasting Value", CRC Press, ISBN: 9781482234329,2016.
2. Paige Wilson, Teresa Ferster Glazier," The Least You Should Know About English: Writing Skills, Form C", Cengage Learning, ISBN: 9781111830922,2013.

**OUTCOMES :**

Students who complete this course will be able to

- Demonstrates how effective writing can be achieved through engineering-based

thinking.

- Locate the basic errors and mistakes for designing a document.
- Become expert in technical writing.
- Describe the writing skills formally.
- Become effective writers.
- Inbuilt confident on writing any technical document.

**CSC X148 SOFTWARE RELIABILITY L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To understand how to apply the principles of software reliability in a variety of context.
- To learn the techniques to find the reliability of software.
- To know the different models of software reliability.
- To study the various metrics used to measure the quality factors of software reliability
- To identify the responsibility of organization and staffing in achieving software reliability, and computer architecture and program correctness
- To explain the fault detection and correction approaches used in developing a quality software
- To illustrate the design principles for achieving higher reliable software system

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**MODULE I SOFTWARE RELIABILITY CONCEPTS 10**

Defining failure for the product, common measure for all associated systems, setting system failure intensity objectives, determining develop software failure intensity objectives, software reliability strategies, failures, faults and errors, availability, system and component reliabilities and failure intensities, predicting basic failure intensity.

**MODULE II SOFTWAR RELIABILITY MODELING SURVEY 10**

Introduction, Historical Perspective and Implementation, Exponential Failure Time Class of Models, Weibull and Gamma Failure Time Class of Models, Infinite Failure Category Models,Bayesian Models, Model Relationship, Software Reliability Prediction in Early Phases of the Life Cycle, software reliability growth modeling.

**MODULE III SOFTWARE METRICS FOR RELIABILITY ASSESSMENT 10**

Introduction, Static Program Complexity, Dynamic Program Complexity, Software Complexity and Software Quality, Software Reliability Modeling

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Betsy Beyer, Chris Jones,“Site Reliability Engineering”, O’Reily Publishers,1st Edition,ISBN: 9781491929124,2016.

2. Shigeru Yamada “Software Reliability Modeling: Fundamentals and Applications”, Springer publishers, ISBN: 9784431545644, 2014.
3. Michael R.Lyu, “ Handbook of Software Reliability Engineering”, Tata McGrawHill Publications, ISBN:9780070394001,2005.

**OUTCOMES :**

Students who complete this course will be able to

- Know the process and basic activities of software reliability engineering
- Apply methods for ensuring, evaluation and enhancing of software reliability
- Work better with other professionals at an organization to make decisions about the reliability of software.
- Implement different software reliability models and to evaluate the reliability of developed tool using different methods and tools.
- Apply the knowledge and select an appropriate software reliability model
- Perform an evaluation of software reliability and in case of necessity to enhance reliability.

| CSC X149 | AAIP – ANIMATION WITH PORTFOLIO DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES :**

- To design a character for both 2D and 3D animation.
- To create new animations that may be needed to supplement existing body of work
- To develop a high quality student animation reel.
- To design and create a web-base location to host animation samples.
- To create a portfolio specific to a particular medium and purpose.
- To demonstrate skill in industry standard tools and techniques of 3D Animation.

**MODULE I INTRODUCTION 10**

How animation works – Flipping, Flicking and Rolling – Bouncing ball in 2D and 3D– Principles of animation- How to design a 3D Character

**MODULE II ANIMATION OF INANIMATED OBJECTS 10**

Inanimate Objects : Weight,Solidity,Force- Animation of Solids: Bowling Ball, Soccer Ball– Animation of Liquids : Drip ,Splash – Animal walks.

**MODULE III ANIMATIONS & REALISM 10**

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

**PRACTICAL**

- 2D Digital Animation
- Basic Scripting & Interactivity
- 2D Animation Portfolio
- Claymation – A stop-motion animation technique
- 3D Basics – Modeling to Animation
- Modeling in 3D
- 3D Animation Portfolio
- Pixar RenderMan
- Crowd Simulation

- 3D Projection Mapping
- Augmented Reality
- 3D Modeling
- Texturing, Lighting & Rendering
- Paint Effects - Visor
- Portfolio Demo Reel

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

**REFERENCES :**

1. Steve Roberts, “Character animation fundamentals: Developing skills for 2D and 3D character Animation”, Elsevier Ltd, ISBN:9780240522272,2012.
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, “Fundamental of Computer Graphics”, CRC Press, Fourth edition, ISBN: 9781498785907, 2015.
3. Chris Webster,"Action Analysis for Animators", Focal Press; 1 edition,ISBN-13: 978-0240812182,2012
4. Sheila Graber, “ Animation A Handy Guide”,A&C Black Published , first edition, ISBN: 978140810283, 2009.

**OUTCOMES :**

Students who complete this course will be able to

- Create work in a variety of animation techniques including 3D animation, stop-motion and experimental methods.
- Collect and review body of personal animation samples
- Discuss learning experiences across disciplines in the University and establish connections to their own animation practices.
- Build and manipulate web media objects using editing software.
- Make animated sequences from the development of the original concept through design to final film or video production.
- Integrate the concepts, principles and theories involved in the physics of animation in all aspects of drawing.

**CSC X150 ADVANCED SAS: MACROS & SQL**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES :**

- To impart about basics of statistical analysis.
- To render the students to apply data analysis concepts.
- To expose the students to use macros and automate a process.
- To apply the SAS concepts in data management, applications development and data warehousing.
- To create macro programs to reduce the complexity of SAS
- To use SQL and SAS in effective database management.

**MODULE I DATA MANIPULATION AND THE SAS PROGRAMMING LANGUAGE** **10**

Introduction to SAS- Reading Raw Data from External Files - Displaying Your Data- Using Advanced INPUT Techniques.

**MODULE II SAS MACRO LANGUAGE** **10**

Introduction- Macro Variables-Built-In Macro Variables - LET Statement - Demonstrating a Simple Macro- Tokens -a Macro Variable as a Prefix –transfer of value between DATA Steps.

**MODULE III SAS STRUCTURED QUERY LANGUAGE** **10**

Basics-Joining Two Tables (Merge) -Left, Right, and Full Joins-Concatenating Data Sets -Summary Functions -an ORDER Clause -Fuzzy Matching.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Alan C. Elliott, Wayne A. Woodward ”SAS Essentials: Mastering SAS for Data Analytics, 2nd Edition,ISBN: 978-1-119-04216-7,2015
2. Ron Cody, “Learning SAS® by Example: A Programmer's Guide”, Sas Inst Edition ISBN: 9781599941653, 1599941651,2010

**OUTCOMES :**

Students who complete this course will be able to

- Develop new macro code to write more efficient SAS programs .

- Utilize the SQL procedure as an easy, flexible way to query and combine your data.
- Apply advanced SAS programming techniques such as creating samples and indexes, using lookup tables to match data, and modifying and tracking data set changes.
- Transcribe SAS programs to maximize efficiency.
- Create SAS variables and recode data values.
- Using advanced DATA step programming statements to improve efficiency.

**CSC X151 ADVANCED PROGRAMMING FOR DATA SCIENCE WITH PYTHON**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To know the basics of Data science.
- To Learn different types of tools for data science.
- To Learn theadvanced NumPy (Numerical Python) features.
- To provide computational environments for data scientists using Python.
- To expose the features of DataFrame for efficient storage and manipulation of labeled/columnar data in Python
- To know the capabilities for a flexible range of data visualizations in Python

**MODULE I INTRODUCTION 07**

Data Science – Python for Data Analysis – Essential Python Libraries – Installation and setup – Dataset Retrieval.

**MODULE II IPYTHON 08**

IPython: Beyond normal Python – Launching IPython Shell – Launching Jupiter Notebook – Exploring Modules with Tab completion – shortcuts – Ipython Magic Commands – Running External Code – In and Out Objects.

**MODULE III NUMPY 08**

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions - Aggregations: Min, Max- Computation on Arrays: Broadcasting - Comparisons, Masks, and Boolean Logic - Fancy Indexing.

**MODULE IV DATA MANIPULATION WITH PANDAS 08**

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Combining Datasets: Concat and Append - Combining Datasets: Merge and Join.

**MODULE V VISUALIZATION WITH MATPLOTLIB 08**

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Text and Annotation.

**MODULE VI APPLICATIONS 06**

Analyzing unstructured data with Text Mining – Python in Big Data -Real Time Applications - Case Study.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O'Reilly Media, 1st Edition, ISBN: 9781491912058, 2016.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ”, O'Reilly Media, 1st Edition , ISBN: B009NLMB8Q, 2012.
3. Joel Grus, “Data Science from Scratch: First Principles with Python”, O'Reilly Media, 1st Edition , ISBN: 9781491901427, 2015
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Use high-performance tools to load, clean, transform, merge, and reshape data.
- Apply data analysis tools in the pandas library.
- Demonstrate with Shell commands in Python.
- Apply the pandas group by facility to slice, dice, and summarize datasets.
- Create scatter plots and static or interactive visualizations with matplotlib.
- Solve real world problems in web analytics, social sciences, finance, and economics.

**Elective 2**

| CSC X155 | SECURITY ISSUES IN CLOUD COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To study the basic concepts of security systems and Trusted baselines, which are widely used in the design of cloud security.
- To identify the suitable architecture for securing the cloud infrastructure.
- Identify the known threats and risks associated with secure cloud architecture.
- Understand the concepts and guiding principles for designing and implementing appropriate safeguards and countermeasures for Cloud based Datacenters.
- To learn the security attacks in Cloud computing.
- To discuss the basic concepts of cloud computing security to analyze and attract the vital resources required to turn a vision into reality.

**MODULE I INTRODUCTION 08**

Cloud computing Essentials-Overview of cloud computing-Cloud security baselines-Cloud security baselines-Cloud security, Privacy and Trusted Baselines-Infrastructure as a Service(Iaas)

**MODULE II RISK ANALYSIS AND DIVISION OF RESPONSIBILITY 07**

Risk and Trust Assessment: Schemes for Cloud services-Managing Risk in the Cloud-Cloud Risk Management-Secure Cloud Risk Management: Risk Mitigation Methods.

**MODULE III SECURING THE CLOUD INFRASTRUCTURE 07**

Cryptographic Key Management for Data Protection-Cloud security Access control-Cloud security key management-cloud computing security essentials and architecture-secure cloud architecture.

**MODULE IV TRUSTED COMPUTING TECHNOLOGY 08**

Trusted Computing Technology-Trusted cloud security-cloud computing security problems-Assuring Compliance with Government Certification –Accreditation-Regulations.

**MODULE V CLOUD DATA CENTERS 07**

Secure Cloud Computing Environments with Cloud Data Centers-Availability-Recovery and Auditing across Data Centers.

**MODULE VI ADVANCED CLOUD COMPUTING SECURITY 08**

Advanced Security Architectures for cloud computing-side channel Attacks and Defenses on Cloud Traffic-Cloud Computing Security: Risks and challenges.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. John vacca ”Cloud Computing Security: Foundations and Challenges”,CRC Press Publisher,1st Edition,ISBN: 978-1-4822-6094-6,1st Edition,2016.
2. Melvin B. Greer, Jr., Kevin L. Jackson,” Practical Cloud Security: A Cross-Industry View”,CRC Press, ISBN: 9781498729444,2016.
3. John Rittinghouse, James Ransome,” Cloud Computing”,CRC Press,1st Edition,ISBN:9781439806814,2016.

**OUTCOMES :**

Students who complete this course will be able to

- Compare modern security concepts as they are applied to cloud computing.
- Assess the security attacks of cloud computing system.
- Evaluate the schemes related to cloud services.
- Appraise compliance issues that arise from cloud computing.
- Describe the security of cloud computing environment with cloud datacenters.
- Evaluate the security attacks and defenses on cloud traffic.

**CSC X156 SECURITY EVALUATION AND ASSESSMENT METHODOLOGY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To learn the basic principles of security evaluation process.
- To choose and apply the right penetration technique for a given situation.
- To evaluate different methods for access control.
- To identify appropriate strategies to assure confidentiality, integrity, and availability of information.
- To identify components and basic requirements for creating a security policy framework.
- To communicate their analyses and decisions effectively.

**MODULE I OVERVIEW 07**

Introduction to Security Evaluation – Policies, standards, guidelines – elements and Development – Evaluation Criteria.

**MODULE II PRE EVALUATION 08**

Setting Expectations – Scoping the Evaluation – Legal Principles for Security Evaluation – building the Technical Evaluation Plan

**MODULE III ONLINE AND POST EVALUATION 08**

How to start Onsite Efforts – Network Discovery Activities – fine tuning the Evaluation – Post Evaluation Analysis – Trending Metrics – final Reporting

**MODULE IV SECURITY ASSESSMENT 07**

Importance - Process – Methods – Techniques- system and Network Assessment

**MODULE V SECURITY COMPONENT FUNDAMENTALS FOR ASSESSMENT 07**

Management Controls – Security Services Life Cycle – Physical and Personnel security –wireless Networking

**MODULE VI EVIDENCE OF ASSESSMENT AND REPORTING 08**

Evidence Types – Documentation Requirements – Key elements of Reporting –

Assessment Findings – Security assessment report – risk assessment report – Artifacts as reports – Executive Summary

**L – 45; TOTAL HOURS-45**

**REFERENCES :**


1. Leighton Johnson, “Security Controls Evaluation, Testing, and Assessment Handbook”, Elsevier Publishers, 1st Edition, ISBN: 9780128023242, 2015.
2. Sudhanshu Kairab,”A Practical Guide to Security Assessment”, Auerbach Publications , CRC press,1st Edition, ISBN: 9780849317064,2007.
3. Debra.S.Herrman, “Using the Common Criteria for IT Security Evaluation”, Auerbach Publications , CRC press,1st Edition, ISBN:0849314046,2005.
4. Bryan Cunningham, Ted Dykstra, Ed Fuller, Matthew Hoagberg, Chuck Little, Greg Miles, Travis Schack and Russ Rogers, “Network Security Evaluation using the NSA IEM”, Elsevier Publishers, ISBN: 978159749035,2005.


**OUTCOMES :**

Students who complete this course will be able to

- Analyze critically the design and document the core issues and requirements in building secure and effective networks systems
- Assess existing systems using the theories, techniques, and software tools that are available in the field of information security and computer networks
- Analyze issues and solutions in security and network design as they affect general and particular communities
- Evaluate and assess the components of assessment.
- Apply and operationalize network security technologies and techniques.
- Analyze how security policies help mitigate risks and support business.

**CSC X157 SOFTWARE PROCESS & PRODUCT QUALITY**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To explain the basic concepts of the software process and modeling.
- To discuss the detailed concepts of descriptive process modeling.
- To describe the software process engineering meta model and tools.
- To collect data to measure product factors and aggregate the results up to quality aspects.
- To analyze the product quality based on the quality evaluation and measures.
- To focus on the individual development of business information systems.

**MODULE I THE SOFTWARE PROCESS 07**

Motivation - Software Process Modeling and improvement – Process modeling goals and Benefits – Prescriptive process models – classes – Process standards – Goals of descriptive process models - creation - descriptive process modeling alternatives – Managing risk in descriptive process modeling efforts - Process modeling notations and tools

**MODULE II SOFTWARE QUALITY 08**

Introduction - Software Quality-Terms and Definitions-Overview of SQuaRE series of standards- Quality Models set into context- Software measures- Quamoco quality models - Quality model maintenance - Model building and requirements-Quality control loop-Quality evaluation and measurements

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Jurgen Munch, Ove Armbrust, Martin Kowalczyk, Martín Soto, Software Process Definition and Management, Springer Science & Business Media, ISBN: 978-3-642-24291-5, 2012.
2. Wagner, Stefan, Software product quality control, Springer, ISBN:978-3-642-38570-4, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Explore the basic concepts of the software process.
- Illustrate the goals, creation and guidelines of the descriptive process models.

- Understand the process modeling and apply the models using tools.
- To summarize quality terms, definitions, standards and measures.
- Analyze the Product quality based on the quality evaluation and measures.
- Apply the quality control knowledge into real time case study.

**CSC X158 SYSTEM INTEGRATION L T P C**
**2 0 0 2**

**OBJECTIVES :**

- Define the basics and other technical aspects associated in the integration of various applications.
- To analyze various process models and apply for better systems integration.
- To plan the system process for appropriate integrations.
- Identify information systems application and organization characteristics to carry out the concurrency.
- Discuss the characteristics of systems integration process in each project emphasizing various management issues.
- Explain the requirement analysis that help in systems integration by identifying the appropriate tools facilitate the creation of such services.
-

**MODULE I INTRODUCTION 10**

Introduction to integration-principles of integration-essence of integration-metrics-constraint –framework.

**MODULE II PROCESS INTEGRATION 10**

Interfaces-Functional Analysis-Organizational models-Issues-limits-Lifecycle stages-metrics-Problem domain analysis-Stakeholder Analysis-Process model.

**MODULE III INTEGRATION MANAGEMENT 10**

Granularity-Abstraction-process management-quality-Integration strategy-Integration model-patterns

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. E Gary O. Langford “Engineering Systems Integration: Theory, Metrics, and Methods” by CRC Press, ISBN 9781138074125, 2017.
2. Andrea Prencipe, Andrew Davies, Mike Hobday “.The Business of Systems Integration” Oxford University Press, USA. ISBN-10: 9780199263233,2005
3. Fred A. Cummins ,”Enterprise Integration: An Architecture for Enterprise Application and Systems Integration” Wiley1st Edition. ISBN-10: 0471400106,2002

**OUTCOMES :**

Students who complete this course will be able to

- Identify the key challenges, basic concepts, and strategies related to systems integration projects.
- Solve organizational and managerial issues related to systems integration projects.
- Apply key systems integration architecture, methodologies, and technologies assessing the application.
- Define and analyze systems integration requirements based on the business process models.
- Design feasible solutions for an integration problem that utilizes proven design solutions described in integration patterns.
- Apply latest integration technologies to implement system integration solutions.

**CSC X159** **IBM WEBSPHERE** **L T P C**
**2 0 2 3**

**OBJECTIVES :**

- Cognize the basic features and standards in WebSphere Application.
- Learn how to apply architectural concepts relating to WebSphere Application Server .
- Analyze and perform configure messaging with the service integration bus.
- Understand about the management features which can be applied to various applications.
- Describe about the various WebSphere batch features and how to apply in applications.
- Use WebSphere administrative tools to configure and manage enterprise applications.

**MODULE I APPLICATION ARCHITECTURE 08**

Application Architecture- Architects and Architecture - Application Architecture and Engineering - WebSphere and IBM - IBM WebSphere Application Server – Building Blocks of Application Architecture - Layers Versus Tiers - Deployment Patterns for a Layered Architecture- Layers Versus Modules- A View Perspective on Architecture - Organizational Standards and Conventions .

**MODULE II MIDDLE TIERS AND PRESENTATION FRAMEWORKS 07**

Types of Persistence Frameworks - Object/Relational Mapping - SQL-Based Frameworks - iBATIS Framework- Implementing the Customer Class and Customer SQL Mapping-DAO Framework - EJB 3 and the Java Persistence - Business Logic - Business Layer Accessible -Unit Testing - Mapping Shared Libraries to Class Loaders- Testing the Business Layer - Choosing a Presentation Framework Lifecycle Phase Listener

**MODULE III SOA and Web Services 08**

Architecture -Virtual Portal Technology - Business-to-Employee (B2E) Portals- Business Process or Forms-Based Portal--Portals Versus the Web App- Role-based Navigation and Content Delivery - Security and Single Sign-on-Content Personalization- Portlet Aggregation and Composite Applications- The Java Portlet API -Service Modeling- Services as Business Functions - Managing Service Data

Elements-Performance - Standardization – Manageability-Building a New Client Application

**MODULE IV CACHING AND PERFORMANCE 08**

Designing for Performance- Architecture Concerns- Performance Terminology-Caching Considerations-Caching Design Options - IBM HTTP Server and the Caching Plug-in - Distributed Map

**MODULE V SECURITY 07**

Security Architect - SQL Injection Example-Protecting against SQL Injection Attacks- WebSphere Security Basics- Authenticating Application Users- Adding a Filter to the Login Process - Architecting for Security - WebSphere Single Sign-on - WebSphere Authorization .

**MODULE VI APPLICATIONS 07**

Managing Applications - Enforcing Architecture Adherence -Managing Organizational Process - Registry and Repository - Project Methodology - Common Methodology Problems -Change Control Board.

**L – 30; P – 30;TOTAL HOURS-60**

**REFERENCES :**

1. Kyle Brown, Roland Barcia, Karl Bishop, Perrins, “Modern Web Development with IBM WebSphere: Developing, Deploying, and Managing Mobile and Multi-Platform Apps” Pearson Education, ISBN9780133067033,2014
2. Joey Bernal” Application Architecture for WebSphere: A Practical Approach to Building WebSphere Applications” IBM Press ISBN: 9780137005772,2008

**OUTCOMES :**

Students who complete this course will be able to

- Deploy applications in clustered environments by understanding the various technologies.
- Measure the performance information about server and application components.
- Use WebSphere Application Server to ease administration in a scalable, single-server deployment environment.
- Analyze the Web services application platform which delivers a high performance transaction.

- Develop Simple, rapid development and deployment WebSphere Application that helps to improve time and production quickly.
- Improve the flexibility and adaptability of the application services to make it more reusable and accessible to users.

**CSC X160** **AVIP - BROADCAST** **L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To gain knowledge about existing supporting technologies for broadcasting
- To learn about various broadcast technologies
- To gain knowledge about production components and transmitter systems hardware
- To test and measure the performance of the broadcasting system
- To create and manage the digital content, the interface of digital subsystems, and the operation of the most widespread terrestrial and satellite transmission protocols.
- Analyze digital terrestrial and satellite television signals and assess the impact of each parameter in playback fidelity; select optimal settings for parameters.

**MODULE I SUPPORTING TECHNOLOGIES 07**

Broadcasting basis-Quantities and Units – Information Theory and Error Correction – Coaxial Cable and Optical Fibers – TCP/IP Networking – SAN and NAS Technologies – Telco Technologies – Color Displays and colorimetry.

**MODULE II BROADCAST TECHNOLOGIES AND STANDARDS 08**

Linear Digital Audio – Non Linear Audio Systems – Television Standards and Broadcasting Spectrum – Color Encoding and decoding Systems – Time code –Sound in Syncs – VBI Data Carriage – Digital Interfaces for Broadcast Signals – Storage File Formats – HDTV Standards – MPEG-2 – DVB standards –Data Broadcast – ATSC Video, Audio and PSIP Transmission –Interactive TV – Encryption systems.

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Tozer EPJ , “Broadcast Engineer's Reference Book ”, Focal Press, 1st Edition, ISBN: 0240519086,ASIN: B00IC84JMC,2012
2. Michael Talbot Smith, “Broadcast Sound Technology”, Butterworth-Heinemann,1st Edition, ASIN: B01DRY5C0I,,2013
3. Jerry C. Whitaker (Author), Sbe Society Of Broadcast Engineers,”The SBE Broadcast Engineering Handbook: A Hands-on Guide to Station Design and Maintenance (Electronics”), McGraw-Hill Education,1st Edition, ISBN-10: 0071826262,ISBN-13: 978- 0071826266, 2013

**OUTCOMES :**

Students who complete this course will be able to

- Evaluate and critique broadcast and production practices both holistically and in terms of their component parts, namely: audio, video, scripting, production and editing.
- Write effectively for broadcast media and client-based production, with an emphasis on clarity, story structure and brevity.
- Demonstrate competency in shooting and editing video in the field and studio, using professional-level equipment and non-linear editing systems.
- Demonstrate proficiency in recording and editing for audio productions.
- Produce sophisticated deliverables for clients in a variety of areas, namely: corporate/industrial, informational/educational and commercial/promotional.
- Synthesize business, marketing and advertising contexts and concerns with the technical aspects of producing media.

**CSC X161 FULL STACK MOBILE APPLICATION DEVELOPMENT I (FRONT END)**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**OBJECTIVES :**

- Provide an overview of the web framework
- Show the steps in building a web page from scratch
- Introduce the notion of scripting and control functions in web pages
- Explain the Bootstrap CSS framework into web design
- Illustrate the facilities in the Angular JS Javasript App framework
- Show how the views can be redesigned with the ReactJS framework

**MODULE I BASICS 07**

HTML –Basics - Common elements – Formatting HTML text –Headings - Style – Tables – Forms – Element grouping – Graphics – Media – APIs – Examples –CSS – Syntax – Colors – Backgrounds – Margins – Text – Font – List – Tables – Examples.

**MODULE II JAVASCRIPT 08**

Javascript – Variables –Operators – Datatypes –Objects – Scope – Events - Functions – Control loops – Arrays –Forms – Forms API - DOM –Events – Strings - Numbers - Simple UI design – JSON.

**MODULE III JQUERY 08**

Basics –DOM- CSS – Chaining – Jquery function - Filters –custom filters – selector filters - Functions – Traversal –Traversal up the DOM – CSS expressions – Forms – Manipulation - Creating, operating, and adding HTML on the fly- HTML forms Events

**MODULE IV BOOTSTRAP 07**

User Input - Forms – Tables – Images – Media - Bootstrap Javascript components – Advanced programming - Case studies.

**MODULE V DESIGN OF EXPERIMENTS 08**

Angular JS - Directives – Filters – Data binding – Views – Controllers – Scope – Modules – Creating a container in a Module - Routes - Role of Routes– Factories - Services – Example Case study .

**MODULE VI React JS 07**

Statefull Vs Stateless Components – Container react application – Solving a problem using React- React lifecycle – Building complex React components – Using Flux in ReactJS – Case studies on using ReactJS.

**L – 30; P – 30;TOTAL HOURS-60**

**REFERENCES :**


1. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, “Mastering HTML, CSS & Javascript”, BPB Publications; First edition, ISBN-10: 8183335152, 2016
2. Chris Aquino, Todd Gandee, “Front-End Web Development: The Big Nerd Ranch Guide”, Oreilly Publishing, ISBN-10: 0134433947, 2016
3. Cody Lindley , “jQuery Cookbook", Oreilly Publishing, ISBN 10: 1449342841 , 2010.
4. Dan Wahlin,”AngularJS in 60 Minutes”, Wahlin Consulting – 2013, ISBN: 989948351620
5. Artemij Fedosejev, “React.JS Essentials”, PACKT Publishing, ISBN: 9781783551620, 2015.


**OUTCOMES :**

Students who complete this course will be able to

- Build a basic web page using HTML and CSS
- Control the web page design with the Javascript functions
- Expand the views and libraries using CSS and ReactJS
- Use the Bootstrap framework for developing responsive, mobile first projects on the web
- Use JQuery for DOM traversal, event handling and animation
- Implement the MVC pattern to separate presentation, data, and logic components using the AngularJS components
- Update the View for the user and control the application workflow using ReactJS

**CSC X162 ADVANCED GAME DESIGN L T P C**
**2 0 0 2**

**OBJECTIVES :**

- To understand of game design and development
- To understand the processes, mechanics, issues in game design, game engine development
- To expose the students to study OpenGL programming
- To understand modeling, techniques, handling situations, and logic
- To expose the students to study various Gaming tools and platforms.
- To develop 2D and 3D games

**MODULE I 3D GRAPHICS FOR GAME PROGRAMMING 08**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

**MODULE II GAME DESIGN PRINCIPLES 12**

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding. Game Engine Design: Rendering, Controller based animation, collision detection, standard objects, and physics.

**MODULE III GAMING PLATFORMS AND FRAMEWORKS 10**

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity. Game development : Developing 2D and 3D interactive games using OpenGL, DirectX – Puzzle games, Single / Multi player games.

**L- 30;TOTAL HOURS-30**

**REFERENCES :**

1. Jeannie Novak, “Game Development Essentials”, 3rd Edition, Delmar Cengage Learning, ISBN-13: 978-1111307653, 2011
2. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, “Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer”, 1st edition, Wiley, ISBN 0471968943, 2007

3. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” , Morgan Kaufmann, 2 Edition, ISBN-13: 978-0122290633, 2006

**OUTCOMES :**

Students who complete this course will be able to

- Able to understand and apply 3 D concepts in Game programming
- Gain knowledge about principles and levels of design in various game development
- Gain knowledge about gaming engine design for controlling
- Explore into various platforms and frameworks available for game development
- Able to design and develop interactive games
- Explore various tools for creating games

**Elective 3**

| CSC X166 | WEB APPLICATION SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |

**OBJECTIVES :**

To learn about the security concepts.

To summarize the anatomy of the web related to security.

To discuss about the security policies available for the system.

To enhance security for designing the system.

To learn new and future security features.

To identify the security features for the future web applications.

**MODULE I ANATOMY OF THE WEB 10**

Security in the world of web applications – it starts with a URL – reserved characters and percent encoding – resolution of relative URLs – Hypertext Transfer protocol – Hypertext Markup Language -CSS.

**MODULE II BROWSER SECURITY FEATURES 10**

Content isolation logic – Origin inheritance – Life outside same origin rules – Content recognition mechanisms.

**MODULE III A GLIMPSE OF THINGS TO COME 10**

New and upcoming security features – Other browser mechanisms of note - Common web vulnerabilities.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Michal Zalewski, The Tangled Web: A Guide to Securing Modern Web Applications, No Starch Press, ISBN: 9781593273880, 2012.
2. 2.
3. Nishant Das Patnaik, Developing Secure Applications, Apress, ISBN: 978-1-43-025875-9, 2018.

**OUTCOMES :**

Students who complete this course will be able to

- Describe the server issues and security measures into web applications
- Explore basic ways to secure web application.

- Summarize the security policies available for the system
- Show how to better secure the web applications and how to design the secure system against attacks.
- Identify the security problems existing in the web application.

**CSC X167 CYBER LAWS & ETHICS L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To give awareness about the building blocks of Cyber crime.
- To learn about the ethical values of Internet
- To learn the theoretical and practical aspects of cyber law
- To provide an insight knowledge on Intellectual property rights
- To explore the Computer Security concepts
- To acquire the knowledge of various Case laws relating to IT
-

**MODULE I INTRODUCTION 10**

Cyber crime - Categories - kinds– Internet Security- Computer Security and legal aspects– Copyright - Cyber Space Jurisdiction.

**MODULE II CYBER LAW 10**

Internet Governance- IT ACT - Scope and Application - Cyber Contraventions- Adjudication- Appellate Tribunal and Offences -Case laws relating to IT ACT.

**MODULE III CYBER ETHICS 10**

Internet and ethical values – Ethics of blogging-Facebook threat-- Free speech and content controls in cyber space - Intellectual property in cyber space.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. Sushma Arora and Raman Arora, “Cyber Crimes & Laws”, Taxmann Publications, ISBN: 9789350719879, 2016.
2. Richard A. Spinello, “Cyber Ethics-Morality and Law in cyberspace”, Jones and Bartlett Learning, 6th Edition, ISBN: 9781284081398, 2017.
3. Joan Ruttenberg, Paige von Mehren and Julie Yen “, The OPIA Insider’s Guide to Intellectual Property And Cyberlaw”, Bernard Koteen Office of Public Interest Advising Harvard Law School, 7th Edition, ISBN: 978813170205, 2013.

**OUTCOMES :**

Students who complete this course will be able to

- Comprehend the concepts and categories of cyber crime
- Design and implement ethical laws for Internet

- Develop skills of using IT ACT for solving practical problems.
- Apply the appropriate ethics while using social networks
- Analyze the importance of Intellectual property in cyber space.
- Identify the appropriate laws and ethics required to secure computers.

**CSC X168 SECURE INTERCONNECTING SYSTEMS L T P C**

**3 0 0 3**

**OBJECTIVES :**

- To define fundamentals and basic principles that are necessary for the network security protocols, such as the SSL/TLS protocols.
- To explain the perspective of the various technologies and protocols that can be used to provide basic security services at the transport layer of the TCP/IP protocol stack.
- To illustrate Traffic and security analysis of TLS and DTLS protocols
- To address the issues those are relevant for the understanding of the SSL/TLS protocols and their proper use.
- To estimate security measures of the system and using the techniques detect or protect the security related issues.
- To evaluate the security services based on the security standards.

**MODULE I INTRODUCTION 06**

OSI security Architecture – Security Definition – Cryptography Systems – Classes – Secure Cryptosystems – History – Legal Situation – Crypto systems – unkeyed – super key – public key

**MODULE II TRANSPORT LAYER SECURITY 07**

Introduction – protocol evolution – SSL Protocol – Record protocols - Handshake protocol – Change cipher spec protocol – Alert protocol – Application Data Protocol – Traffic analysis of a SSL session - Security analysis

**MODULE III TLS PROTOCOL 09**

Introduction – TLS1.0 –TLS 1.1 – TLS 1.2 – Traffic analysis of a TLS session – Security analysis – DTLS Protocol – DTLS1.0 – DTLS 1.2 – Security analysis

**MODULE IV FIREWALL AND PUBLIC KEY CONCEPT 08**

Firewall traversal – SSL/TLS tunneling – SSL/TLS Proxying – Public key Certificates – PGP certificates – X.509 Certificates: Wild card Certificates, International step up and SGC Certificates, Extended validation Certificates – Client Certificates

**MODULE V INTERNET SECURITY 08**

System Intrusion detection and prevention – Computer forensics – Network forensics –

Forensics tools – Scanning, filtering and blocking – Virus filtering – Content filtering.

**MODULE VI STANDARDIZATION AND SECURITY CRITERIA 07**

Product standardization – security evaluations – Major security evaluation criteria – Conquering the last frontier in the digital invasion

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Oppliger, Rolf. SSL and TLS: Theory and Practice, Second edition, Artech House, ISBN- 978-1-59693-447-4, 2016.
2. Joseph Migga Kizza, Guide to Computer Network Security Computer Communications and Networks, 3rd edition, Springer, ISBN: 9781447166542, 2015.
3. Singh, Brijendra. Network Security and Management, PHI Learning Pvt. Ltd., ISBN: 978-8-12034-497-6, 2011.

**OUTCOMES :**

Students who complete this course will be able to

- Describe the basic principles of cryptography relevant for the SSL/TLS protocols.
- Summarize the overall activities of SSL protocol.
- Compare and contrast the concepts of TLS, SSL protocols and DTLS protocol.
- Analyze how transport layer protocols securely traverse a firewall and certificates.
- Apply the security related techniques to simple scenarios and discuss the techniques.
- To appraise the security services based on the security standards.

**CSC X169 SOFTWARE MAINTENANCE L T P C**

**2 0 0 2**

**OBJECTIVES :**

- To describe the importance of software maintenance.
- To demonstrate the software maintenance processes and tools for maintenance.
- To explain the normal and special practices for software maintenance.
- To expose coherent and comprehensive coverage of software change concepts.
- To have a theoretical base for the skills required to effect, control and manage changes in software systems.
- To study the requirements reengineering and legacy information system in software maintenance.

**MODULE I BASIC CONCEPTS 10**

Evolution Versus Maintenance – Software Evolution Models and Processes – Reengineering: Concepts ,Process, Techniques – Legacy Systems – Impact Analysis – Categories of Maintenance Concepts – Maintenance of cost-based Systems

**MODULE II MAINTENANCE MODELS 10**

Reuse-Oriented Model – Staged Model: Closed Source Model, Open Source Software – Change Mini-Cycle Model – IEEE/EIA Maintenance Process – ISO/IEC 14764 Maintenance Process - Software Configuration Management – CR Workflow.

**MODULE III REENGINEERING AND LEGACY INFORMATION SYSTEM 10**

Reengineering: Concepts ,Process – Code reverse Engineering - Data reverse engineering – Wrapping – Migration : Planning, Methods.

**L – 30;TOTAL HOURS-30**

**REFERENCES :**

1. PriyadarshiTripathy ,KshirasagarNaik , “Software Maintenance and Evolution: A Practitioner's Approach” John Wiley & Sons, Hoboken, NJ , ISBN: 978-0-470-60341-3, 2014.
2. JorgRech , Christian Bunse,” Emerging Technologies for the Evolution and Maintenance of Software Models” ISBN: 9781613504383, 2011.
3. Penny Grubb, Armstrong A .Takang, “Software Maintenance Concepts and Practice”, 3rd Edition, World Scientific Publishing Company, ISBN: 978-9812384263, 2008.
4. Alain April, Alain Abrain, “Software Maintenance Management Evolution and

Continuous Improvement", IEEE computer Society Publication, ISBN: 8780470147078, 2008.

5. Paul Hopkin, "Fundamentals of Risk Management- Understanding, evaluating and implementing effective risk management", 1st Edition, IRM Publishers, Kogan Page Limited, ISBN 978-0-7494-5943-7, 2010.

**OUTCOMES :**

Students who complete this course will be able to

- Formulate the maintenance procedures in routine maintenance.
- Relate process models and software maintenance tools in Software maintenance.
- Apply methods to solve software problems and analyze the case studies in Software maintenance.
- Identify and correct common faults in software applications.
- Utilize operating system components, diagnostic software and supplied documentation to detect and correct faults.
- Describe the maintenance and measurement of reengineering.

**CSC X170 PERSONAL SOFTWARE PROCESS L T P C**

**1 0 0 1**

**OBJECTIVES :**

- To provide an insight into the fundamentals of personal software process.
- To discuss about the PSP structure.
- To make aware of various Software design.
- To give basic knowledge of project planning.
- To focus on the process extensions.
- To enumerate the process of PSP quality management.

**MODULE I INTRODUCTION 08**

Introduction– Uses of the PSP– PSP Structure and Terminology– PSP Concepts– Size Measuring and Estimating.

**MODULE II PSP QUALITY MANAGEMENT 07**

Making and Tracking Project Plans– Planning and Tracking Software Quality – Software Design – Process Extensions and Customization.

**L – 15;TOTAL HOURS-15**

**REFERENCES :**

1. Marsha Pomeroy-Huff and William Nichols , ”The Personal Software Process - Body of Knowledge- Version 2.0” , Software Engineering Process Management Program, Carnegie Mellon University, CMU/SEI-2009-SR-018, 2009.
2. Frank Tsui , Orlando Karam and Barbara Bernal, “ Essentials Of Software Engineering”, Jones & Bartlett Learning, 3rd Edition, ISBN: 9781449691998, 2014.
3. Humphrey, Watts S., “PSP: A Self - Improvement Process for Software Engineers”, MA: Addison - Wesley, 1st Edition, ISBN-13: 978-03213054972007, 2005.
4. Humphrey, Watts S. “Introduction to the Personal Software Process”, Pearson Education, 2nd Edition, ISBN-13: 978-8177586725, 2002.

**OUTCOMES :**

Students who complete this course will be able to

- Define personal software process and explain its applications.
- Describe the PSP structure.
- Analyze the application of PSP Software design templates.

- Outline the role of personal software process in the development of software product.
- Explain the strengths and weakness of process extensions.

**CSC X171 WEB ANALYTICS AND SOCIAL MEDIA MINING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To establish connectivity and analyze contents of facebook pages.
- To employ clustering on linkedin contacts and apply natural language techniques for mining
- To construct mining strategies for web page content mining.
- To mine the mail box contents and contacts and visualize the analytics.
- To evaluate the contents of Github and generate interest graphs.
- To research upon any real time social media and perform mining and analytics.

**MODULE I MINING TWITTER AND FACEBOOK 08**

Twitter Terminologies, Twitter API connectivity, Exploring trending topics, Searching for tweets, Extraction and frequency analysis, Examining patterns, Visualization, Facebook social graph API, Open graph protocol, Analyzing face book pages, Examining friendships

**MODULE II MINING LINKEDIN AND GOOGLE+ 07**

Making LinkedIn API Requests, Downloading LinkedIn Connections, User Experiences and clustering, Measuring Similarity, Clustering Algorithms, Exploring the Google+ API, Term Frequency and Inverse Document Frequency, Natural Language Toolkit, Finding Similar Documents, Analyzing Bigrams in Human Language.

**MODULE III MINING WEB PAGES 08**

Scraping, Parsing, and Crawling the Web, Breadth-First Search in Web Crawling, Discovering Semantics by Decoding Syntax, Sentence Detection in Human Language Data, Document Summarization, Entity-Centric Analysis, Quality of Analytics for Processing Human Language Data.

**MODULE IV MINING MAIL BOXES 07**

Unix Mailboxes, Getting the Enron Data, Converting a Mail Corpus to a Unix Mailbox, Converting Unix Mailboxes to JSON, JSONified Mail Corpus into MongoDB, Accessing MongoDB with Python, Analyzing the Enron Corpus, Discovering and Visualizing Time-Series Trends, Analyzing Your Own Mail Data.

**MODULE V MINING GITHUB 07**

Creating a GitHub API Connection, Making GitHub API Requests, Modeling Data with Property Graphs, Seeding an Interest Graph, Computing Graph Centrality Measures, Extending the Interest Graph with “Follows” Edges for Users, Using Nodes as Pivots for More Efficient Queries, Visualizing Interest Graphs.

**MODULE VI CASE STUDY – TWITTER 08**

Case study on twitter, Discovering the Trending Topics, Searching for Tweets, Collecting Time-Series Data, Extracting Tweet Entities, Tabulating Frequency Analysis, Getting All Friends or Followers for a User, Crawling a Friendship Graph, Analyzing Tweet Content, Analyzing a User’s Favorite Tweets.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. Matthew A Russell, “Mining the Social Web”, O′Reilly Publications, Second edition, ISBN-13: 978-1449367619, 2013.
2. Reza Zafarani, “Social Media Mining”, Cambridge University Press, ISBN-13: 978-1107512818, 2015.
3. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Sybex Publication, Third revised edition edition, ISBN-13: 978-1118168448, March 2012.

**OUTCOMES :**

Students who complete this course will be able to

- Acquire skills to connect to facebook and analyze its contents and discover patterns.
- Construct a clustering model to explore the linkedin connectivity patterns and user groups.
- Formulate mining strategies to perform content mining on web pages.
- Establish connectivity to mailbox contents, mine and visually present the outcomes.
- Interpret the interest graphs generated by mining the contents of Github
- Synthesize and analyze the patterns evolved from mining social media contents.

| CSC X172 | RUBY | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 1 |

**OBJECTIVES :**

- To create the environment for programming with Ruby.
- To give the basic understanding of different types of variables.
- To understand the working principle of conditional structures and working of loops.
- To expose to the concept of objects and object oriented programming.
- To construct classes and derive class inheritance.
- To study the basics of file operations.

**MODULE I PROGRAMMING BASICS IN RUBY 08**

Installing Ruby, variables, Arithmetic operators, input and output, Conditional Structures, Loop structures, Arrays

**MODULE II OBJECTS AND FILES 07**

Objects and built-in objects, Defining classes and creating objects, Object inheritance, File input and output

**TOTAL HOURS-15**

**REFERENCES :**

1. Ophir Frieder, Gideon Frieder, and David Grossman, “Computer Science Programming Basics in Ruby”, O'Reilly Media, Inc. Publisher, ISBN: 9781449356835, 2013.
2. Hal Fulton and Andre Arko , “The Ruby Way: Solutions and Techniques in Ruby Programming”, Addison Wesley, Third edition, ISBN-13: 978-0321714633, 2015.
3. Huw Collingbourne, “The Little Book Of Ruby”, CreateSpace Independent Publishing Platform, ISBN-13: 978-1533191618, 2016.

**OUTCOMES :**

Students who complete this course will be able to

- Install and create a working environment for programming with Ruby.
- Analyze a given scenario and suggest suitable data structures.
- To construct the conditional statements and loop structures to solve simple problems.

- Analyze a real time problem and identify classes with attributes and methods.
- To derive the relationship amongst classes and enumerate their inheritance.
- To provide solutions for solving simple real time problems.

**CSC X173 FULL STACK MOBILE APPLICATION DEVELOPMENT II (BACK END)**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

**OBJECTIVES :**

- Provide an overview of the server side processes in the web.
- Show the steps in retrieval of data from the back end
- Illustrate the file processing operations.
- Enumerate on the networking angle in data processing.
- Provide the overview of the ExpressJS middleware.
- Elucidate the role of MongoB in web processing.

**MODULE I NODE JS BASICS 07**

Basics –Web development Framework – Role of Browser – NodeJS to Angular JS components - Installation – Creation – Writing data to console – Event model – Adding work to event queue –Implementing Callbacks

**MODULE II NODEJS I/O 07**

Working with JSON - Buffer data – Stream data – Compression decompression – Files - Synchronous Versus Asynchronous File System Calls - Opening and Closing Files - Writing Files - Reading Files - Other File System Tasks – Examples.

**MODULE III SERVICES IN NODEJS 08**

Processing URLs - Processing Query Strings and Form Parameters - Understanding Request, Response, and Server Objects - Implementing HTTP Clients and Servers in Node.js - Implementing HTTPS Servers and Clients - Understanding Network Sockets - Understanding TCP Server and Socket Objects - Implementing TCP Socket Servers and Clients - Implementing TLS Servers and Clients.

**MODULE IV EXPRESSJS 07**

The core parts of Express – Middleware- Routing – Sub applications - Conveniences - The ecosystem surrounding Express - Express vs. other web application frameworks - What Express is used for - Third-party modules for Node.js and Express – Example App.

**MODULE V NOSQL AND MONGODB 08**

NoSQL basics – Building the MongoDB Environment - Administering User Accounts -

Configuring Access Control - Administering Databases - Managing Collections - Understanding Database Change Options - Understanding Database Update Operators- Adding Documents to a Collection - Getting Documents from a Collection - Updating Documents in a Collection - Atomically Modifying Documents in a Collection - Saving Documents in a Collection - Using upsert to Insert Documents in a Collection - Deleting Documents from a Collection - Removing a Single Document from a Collection.

**MODULE VI NODEJS AND MONGODB 08**

Understanding Query Objects - Understanding Query options Objects - Finding Specific Sets of Documents - Counting Documents- Limiting Result Sets - Sorting Result Sets - Finding Distinct Field Values - Grouping Results - Applying MapReduce by Aggregating Results - Adding Indexes - Using Capped Collections - Applying Replication - Implementing Sharding.

**L-30; P – 30;TOTAL HOURS-60**

**REFERENCES :**

1. Brad Dayley, “Node.js, MongoDB and AngularJS Web Development”, Addison Wesley, ISBN-10: 0321995783, 2014.
2. Evan M Hahn, “Express in Action: Writing, building and testing NodeJS applications”, Manning Publications, ISBN 9781617292422, 2016.

**OUTCOMES :**

Students who complete this course will be able to

- Implement a highly scalable and dynamic webserver, using Node.js and Express.
- Build server-side web services in JavaScript
- Provision a MongoDB data store for the web applications
- Access and interact with MongoDB from Node.js JavaScript code.
- Implement client-side services that can interact with the Node.js webserver
- Build dynamic browser views that provide rich user interaction with authenticated user accounts.

**CSC X174 5G WIRELESS COMMUNICATION TECHNIQUES L T P C**
**3 0 0 3**

**OBJECTIVES :**

- To provide an overview of fifth-generation (5G) wireless communications systems.
- To impart knowledge about the 5G enabler mmWave Spectrum
- Expose the students to the radio-access technologies.
- To acquaint students with various types of relaying and coding techniques.
- To improve students' understanding of 5G spectrum and Channel model.
- To impart knowledge on the cutting-edge technologies that are main topic for industrial research departments and standardization groups in industry (as well as many academic research groups).

**MODULE I HISTORICAL BACKGROUND 08**

Introduction - Historical background - From ICT to the whole economy - Rationale of 5G - Global initiatives - Standardization activities - 5G use cases and system concept - Use cases and requirements -Requirements and key performance indicators - 5G system concept - Concept overview - Extreme mobile broadband- Massive machine-type communication - Ultra-reliable machine-type communication - Dynamic radio access network - Lean system control plane - Localized contents and traffic flows - Spectrum toolbox

**MODULE II 5G ARCHITECTURE 08**

Introduction - High-level requirements for the 5G architecture - Functional architecture and 5G flexibility - Physical architecture and 5G deployment - Machine-type communications - Fundamental techniques for MTC - Massive MTC - Ultra-reliable low-latency MTC - Device-to-device (D2D) communications - D2D: from 4G to 5G - Radio resource management for mobile broadband D2D - Multi-hop D2D communications for proximity and emergency services - Multi-operator D2D communication - Millimeter wave communications - Spectrum and regulations - Channel propagation - Hardware technologies for mmW systems - Deployment scenarios - Architecture and mobility - Beam forming - Physical layer techniques.

**MODULE III RADIO ACCESS TECHNOLOGIES 08**

The 5G radio-access technologies - Access design principles for multi-user

communications - Multi-carrier with filtering: a new waveform - Non-orthogonal schemes for efficient multiple access - Radio access for V2X communication - Radio access for massive machine-type communication - Massive multiple-input multiple-output (MIMO) systems - Theoretical background - Pilot design for massive MIMO - Resource allocation and transceiver algorithms for massive MIMO - Fundamentals of baseband and RF implementations in massive MIMO - Channel models.

**MODULE IV RELAYING AND WIRELESS NETWORK CODING 08**

The role of relaying and network coding in 5G wireless networks - Multi-flow wireless backhauling - Highly flexible multi-flow relaying - Buffer-aided relaying - Interference management, mobility management, and dynamic reconfiguration - Network deployment types - Interference management in 5G - Mobility management in 5G - Dynamic network reconfiguration in 5G.

**MODULE V 5G SPECTRUM 07**

Spectrum challenges in 5G - 5G spectrum landscape and requirements - Spectrum access modes and sharing scenarios - 5G spectrum technologies - Value of spectrum for 5G: a techno-economic perspective - The 5G wireless propagation channel models - Modeling requirements and scenarios - The METIS channel models.

**MODULE VI SECURITY FOR 5G COMMUNICATIONS 06**

Overview of a Potential 5G Communications -System Architecture - Security Issues and Challenges in 5G – communicationsSystems - User Equipment - Access Networks - Mobile Operator's Core Network - External IP Networks.

**L – 45;TOTAL HOURS-45**

**REFERENCES :**

1. MischaDohler, Jose F. Monserrat, AfifOsseiran, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 1st Edition, ISBN: 9781316653166, June 2016.
2. Fundamentals of 5G Mobile Networks, Jonathan Rodriguez, John Wiley & Sons, Ltd., 2015, 1st Edition, ISBN: 9781118867525..

**OUTCOMES :**

Students who complete this course will be able to

- Describe the rationale of 5G.
- Understand the limitations of current networks as well as the requirements of the

next generation, motivated by the vertical industries

- Illustrate the foreseen architecture for 5G, harnessing all the common views on the current technology trends and the emerging applications
- Evaluate the benefits and detriments of 5G wireless communication.
- Compose a report with recommendations for an use case
- Describe Key components like use of mm-wave spectrum, massive MIMO systems, heterogeneous networks, and device-to-device communications.

## 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 help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- 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 concentration, 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 Ferroelectric Random Access Memory (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, graphene - nanocomposites – applications of nano materials.

**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; P – 30; TOTAL HOURS – 60**

**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.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. 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

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- 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 of 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 and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

**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 good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

**L – 30; P – 30; TOTAL HOURS – 60**

**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.
- apply the knowledge 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 synthesis and 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, grapheme - 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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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 INSTRUMENTATION** **7**

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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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 basic understanding of 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 10**

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 6**

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 7**

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 of 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; P – 30; TOTAL HOURS – 60**

**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 concepts and applications of Dielectric and 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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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.

**MODULE 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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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.
- apply the fundamental concept of photo elasticity 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.

**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.
   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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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.
- know 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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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**

Absorption spectroscopy (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: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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:**

The students should be conversant with the

- 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 coating

**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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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:**

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:**

The students should be 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).

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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:**

The students should be 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** **7**

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.

**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

**L – 30; P – 30; TOTAL HOURS – 60**

**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.

**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

**L – 30; P – 30; TOTAL HOURS – 60**

**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:**

The students will be 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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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.

**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).

**L – 30; P – 30; TOTAL HOURS – 60**

**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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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.

**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.

**L – 30; P – 30; TOTAL HOURS – 60**

**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 IV**

**Semester)**

| | | | | | |
|---|---|---|---|---|---|
| **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 1/3 rules

**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:**

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. 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 |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**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

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**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**

**3 0 0 3**

**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)**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **SSCXO1** | **FUNDAMENTALS OF ECONOMICS** | **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:**

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

**REFERENCES:**

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. 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)**

| | | L | T | P | C |
|---|---|---|---|---|---|
| **SSCXO4** | **ECONOMICS OF SUSTAINABLE DEVELOPMENT** | **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*, 3rd edn., 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 give an exposure to various environmental hazards and disasters: and various concepts and principles to manage 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.

**L – 45; 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

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with 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

**L – 45; 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

**GECX108 PLANT ENGINEERING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 4 |

**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 Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

**MODULE I FUNDAMENTALS OF CYBER SECURITY 7**

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

**MODULE II CYBERCRIME AND CYBEROFFENSES 8**

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

**MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8**

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

**MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8**

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

**MODULE V SECURITY POLICIES 7**

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – 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”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

**OUTCOMES:**

Upon completion of this course, 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 material
- Describe 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:**


3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. 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

- 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)**

| GECX201 | GREEN DESIGN AND SUSTAINABILITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

**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.

**L – 45; 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 relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

**GECX202 APPROPRIATE TECHNOLOGY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

**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.

**L – 45; 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 use suitable technologies for various conditions for 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 |
|---|---|---|---|
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**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 |
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**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

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

**GECX207 MATLAB SIMULINK**

| L | T | P | C |
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**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 $1^{st}$ order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

**MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8**

Converting $2^{nd}$ order and higher ODEs to systems of $1^{st}$ 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:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. 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.
4. 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.
5. Make use of Maltab visual capabilities for all engineering applications.
6. 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 |
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**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 ”Tata McGraw-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 |
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**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**

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**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 |
|---|---|---|---|---|---|
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**OBJECTIVES:**

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. 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:**

1. 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.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. 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', 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 & 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

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

**GECX217** **LEAN MANAGEMENT** **L T P C**

**3 1 0 4**

**OBJECTIVES:**

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

**MODULE I** **8**

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.

**7**

**MODULE VI**

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

**L – 45; Total Hours –45**

**TEXT BOOKS:**

1. The Toyota Way Fieldbook, 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 at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

**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 GEOSPATIAL MODELING & ANALYSIS L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on 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.

**L – 45; T – 0; 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.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.