**PSG INSTITUTE OF TECHNOLOGY AND APPLIED RESEARCH**

**(Approved by AICTE, Affiliated to Anna University Chennai)**

**Neelambur, Coimbatore -641062**


## 2017 Regulations
## CURRICULUM AND SYLLABI

# B.E. COMPUTER SCIENCE AND ENGINEERING

## ANNA UNIVERSITY, CHENNAI

**Vision of the college**

To achieve excellence in education and research, and nurture engineers with ethics, who will face global challenges to serve industry and society

**Mission of the college**

- To facilitate active learning and vocational training.
- To encourage and promote questioning spirit and 'can-do' entrepreneurial attitude.
- To foster industry - institute collaboration.
- To ignite passion for creative work and selfless service towards a sustainable world.
- To provide intellectually stimulating environment, conducive for research.

## Department of Computer Science and Engineering

**Vision:**

To produce Computer Science and Engineering (CSE) graduates, who will be the technology and innovation leaders, with core-competency and proficiency in research, entrepreneurial and inter- personal skills, in order to build path-breaking solutions for a better society and world

**Mission:**

M1: To provide experiential and holistic learning experience by employing innovative teaching practices through Information and Communication Technology (ICT) Tools

M2: To impart collaborative and life-long learning to develop optimal technology solutions for industry needs and societal aspirations with universal human values

M3: To give industry exposure by providing industry-institute-interaction opportunities in order to build inter-disciplinary research capabilities with an inquisitive and innovative mind

M4: To cultivate the spirit of entrepreneurship and empower the students by nurturing leadership skills and facilitating various co-curricular and extra-curricular activities in order to achieve global excellence.

**Program Educational Objectives (PEOs ):**

| | |
|---|---|
| **PEO 1:** | Graduates will influence, lead and excel in creating innovative technologies by employing multidisciplinary research and comprehensive set of skills that are appropriate for global computing industry |
| **PEO 2:** | Graduates will handle organizational leadership positions and have broad understanding of applying ethics in building computing-based solutions for societal needs |
| **PEO 3:** | Graduates will exhibit entrepreneurial traits and will grow in their career by acquiring new knowledge and upgrading their professional, communication and analytic skills continuously |

**PROGRAM OUTCOMES (POs) :**

Engineering Graduates will be able to:

| | |
|---|---|
| **PO1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| **PO2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO5** | **Modern tool usage:** 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** | **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO7** | **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |

| | |
|---|---|
| **PO8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO9** | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO12** | **Life-long learning:** 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. |

**Program Specific Outcomes (PSOs) :**
The Computer Science and Engineering Graduates will demonstrate

| | |
|---|---|
| **PSO 1** | The ability to use algorithmic thinking and data management techniques to develop software solutions |
| **PSO 2** | The ability to employ programming, networking and software project management skills to design complex software systems |

# CURRICULUM AND SYLLABI
# 2017 Regulations

# B.E. COMPUTER SCIENCE AND ENGINEERING

## TABLE OF CONTENTS

**ANNA UNIVERSITY: CHENNAI - 600 025**

**AFFILIATED INSTITUTIONS**

**REGULATIONS 2017**

**CHOICE BASED CREDIT SYSTEM**

**Common to all B.E. / B.Tech. Full-Time Programmes**

**(For the students admitted to B.E. / B.Tech. Programme at various Affiliated Institutions)**

**DEGREE OF BACHELOR OF ENGINEERING / BACHELOR OF TECHNOLOGY**

This Regulations is applicable to the students admitted to B.E/B.Tech. Programmes at all Engineering Colleges affiliated to Anna University, Chennai (other than Autonomous Colleges) and to all the University Colleges of Engineering of Anna University, Chennai from the academic year 2017-2018 onwards.

## 1. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

I) "Programme" means Degree Programme, that is B.E./B.Tech. Degree Programme.

II) "Discipline" means specialization or branch of B.E./B.Tech. Degree Programme, like Civil Engineering, Textile Technology, etc.

III) "Course" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.

IV) "Director, Academic Courses" means the authority of the University who is responsible for all academic activities of the Academic Programmes for implementation of relevant rules of this Regulations pertaining to the Academic Programmes.

V) "Chairman" means the Head of the Faculty.

VI) "Head of the Institution" means the Principal of the College.

VII) "Head of the Department" means head of the Department concerned.

VIII) "Controller of Examinations" means the authority of the University who is responsible for all activities of the University Examinations.

IX) "University" means ANNA UNIVERSITY, CHENNAI.

## 2. ADMISSION

Candidates seeking admission to the first semester of the eight semester B.E. / B.Tech. Degree Programme:

(i) Should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

**(OR)**

(ii) Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

**Lateral entry admission**

(i) The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

**(OR)**

(ii) The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech.

Such candidates shall undergo two additional Engineering subject(s) in the third and fourth semesters as prescribed by the University.

## 3. PROGRAMMES OFFERED

B.E. / B.Tech. Programmes under the Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology.

## 4. STRUCTURE OF PROGRAMMES

**Categorization of Courses**

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

i. Humanities and Social Sciences (HS) courses include Technical English, Engineering Ethics and Human Values, Communication skills, Environmental Science and Engineering.

ii. **Basic Sciences (BS)** courses include Mathematics, Physics, Chemistry, Biology, etc.

iii. **Engineering Sciences (ES)** courses include Engineering practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering, Instrumentation etc.

iv. **Professional Core (PC)** courses include the core courses relevant to the chosen specialization/branch.

v. **Professional Elective (PE)** courses include the elective courses relevant to the chosen specialization/ branch.

vi. **Open Elective (OE)** courses include the courses from other branches which a student can choose from the list specified in the curriculum of the students B.E. / B. Tech. / B. Arch. Programmes.

vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

**Personality and Character Development**

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC/NSS/NSO/YRC) and undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid.

**National Cadet Corps (NCC)** will have about 20 parades.

**National Service Scheme (NSS)** will have social service activities in and around the College / Institution.

**National Sports Organization (NSO)** will have sports, Games, Drills and Physical exercises.

**Youth Red Cross (YRC)** will have activities related to social services in and around College/Institutions.

While the training activities will normally be during weekends, the camp will normally be during vacation period.

**Number of courses per semester**

Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and Laboratory courses and Employability Enhancement Course(s) not exceeding 4. Each Employability Enhancement Course may have credits assigned as per clause 4.4. However, the total number of courses per semester shall not exceed 10.

**Credit Assignment**

Each course is assigned certain number of credits based on the following:

| Contact period per week | Credits |
|---|---|
| 1 Lecture Period | 1 |
| 2 Tutorial Periods | 1 |
| 2 Laboratory Periods (also for EEC courses like / Seminar / Project Work / Case study / etc.) | 1 |

The Contact Periods per week for Tutorials and Practical can only be in multiples of 2.

**4.5. Industrial Training / Internship**

The students may undergo Industrial training for a period as specified in the Curriculum during summer / winter vacation. In this case the training has to be undergone continuously for the entire period.

The students may undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

**Industrial Visit**

Every student is required to go for at least one Industrial Visit every year starting from the second year of the Programme. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

**Value Added Courses**

The Students may optionally undergo Value Added Courses and the credits earned through the Value Added Courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a Department of an institution with the prior approval from the Head of the Institution. The details of the syllabus, time table and faculty may be sent to the Centre for Academic Courses and the Controller of Examinations after approval from the Head of the Institution concerned atleast one month before the course is offered. Students can take a maximum of two one credit courses / one two credit course during the entire duration of the Programme.

**Online Courses**

Students may be permitted to credit only one online course of 3 credits with the approval of Head of the Institution and Centre for Academic Courses.

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. The student needs to obtain certification or credit to become eligible for writing the End Semester

Examination to be conducted by Controller of Examinations, Anna University. The details regarding online courses taken up by students should be sent to the Controller of Examinations, Anna University and Centre for Academic Courses one month before the commencement of End Semester Examination.

The students satisfying the following conditions shall be permitted to carry out their final semester Project work for six months in industry/research organizations.

The student should not have current arrears and shall have CGPA of 7.50 and above.

The student shall undergo the eighth semester courses in the sixth and seventh semesters. The Head of Department, in consultation with the faculty handling the said courses shall forward the proposal recommended by the Head of Institution to the Controller of Examinations through the Director, Centre for Academic courses for approval at least 4 weeks before the commencement of the sixth semester of the programme for approval.

**Medium of Instruction**

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports except for the programmes offered in Tamil Medium.

## 5. DURATION OF THE PROGRAMME

A student is ordinarily expected to complete the B.E. / B.Tech. Programme in 8 semesters (four academic years) but in any case not more than 14 Semesters for HSC (or equivalent) candidates and not more than 12 semesters for Lateral Entry Candidates.

A student is ordinarily expected to complete the B.E. Mechanical Engineering (Sandwich) Programme in 10 semesters (five academic years) but in any case not more than 18 Semesters for HSC (or equivalent) candidates.

Each semester shall normally consist of 75 working days or 540 periods of 50 minutes each. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

The Head of the Institution may conduct additional classes for improvement, special coaching, conduct of model test etc., over and above the specified periods. But for the purpose of calculation of attendance requirement for writing the end semester examinations (as per clause 6) by the students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{\text{Total no. of periods attended in all the courses per semester} \times 100}{\text{(No.of periods / week as prescribed in the curriculum) taken together for all courses of the semester} \times 15}$$

The University Examination will ordinarily follow immediately after the last working day of the semester commencing from I semester as per the academic schedule prescribed from time to time.

The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study (vide clause 18) in order that he/she may be eligible for the award of the degree (vide clause 16).

## 6. COURSE REGISTRATION

The Institution is responsible for registering the courses that each student is proposing to undergo in the ensuing semester. Each student has to register for all courses to be

undergone in the curriculum of a particular semester (with the facility to drop courses to a maximum of 6 credits (vide clause 6.2)). The student can also register for courses for which the student has failed in the earlier semesters.

The registration details of the candidates may be approved by the Head of the Institution and forwarded to the Controller of Examinations. This registration is for undergoing the course as well as for writing the End Semester Examinations. No Elective course shall be offered by any department of any institution unless a minimum 10 students register for the course. However, if the students admitted in the associated Branch and Semester is less than 10, this minimum will not be applicable.

**The courses that a student registers in a particular semester may include**

i. Courses of the current semester.

ii. The core (Theory/Lab /EEC) courses that the student has not cleared in the previous semesters.

iii. Elective courses which the student failed (either the same elective or a different elective instead).

**Flexibility to Drop courses**

A student has to earn the total number of credits specified in the curriculum of the respective Programme of study in order to be eligible to obtain the degree.

From the III to final semesters, the student has the option of dropping existing courses in a semester during registration. Total number of credits of such courses cannot exceed 6.

The student shall register for the project work in the final semester only.

## 7. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes.

Therefore, he/she shall secure not less than 75% (after rounding off to the nearest integer) of overall attendance as calculated as per clause 5.3.

However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.

Candidates who secure less than 65% overall attendance and candidates who do not satisfy the clause 7.1 and 7.2 shall not be permitted to write the University examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

## 8. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the HoD of the department concerned. The class advisor is the ex-officio member and the Convener of the class committee. The responsibilities for the class advisor shall be:

~~• To act as the channel of communication between the HoD and the students of the respective~~

class.

- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

**9. CLASS COMMITTEE**

Every class shall have a class committee consisting of teachers of the class concerned, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein particularly (clause 5 and 7) which should be displayed on college Notice-Board.
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help or guidance or coaching to such weak students.

The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Head of the Institution.

The class committee shall be constituted within the first week of each semester.

At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

The Chairperson of the class committee may invite the Class adviser(s) and the Head of the Department to the class committee meeting.

The Head of the Institution may participate in any class committee of the institution.

The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the Management by the Head of the Institution.

The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. The

Class Committee Chairman shall put on the Notice Board the cumulative attendance particulars of each student at the end of every such meeting to enable the students to know their attendance details to satisfy the clause 6 of this Regulation. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

## 10. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, 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 / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet in order to arrive at a common scheme of evaluation for the test and shall ensure a uniform evaluation of the tests. Wherever feasible, the course committee may also prepare a common question paper for the internal assessment test(s).

## 11. SYSTEM OF EXAMINATION

Performance in each course of study shall be evaluated based on (i) continuous internal assessment throughout the semester and (ii) University examination at the end of the semester.

Each course, both theory and practical (including project work & viva voce Examinations) shall be evaluated for a maximum of 100 marks.

For all theory and practical courses including project work, the continuous internal assessment will carry 20 marks while the End - Semester University examination will carry 80 marks.

Industrial training and seminar shall carry 100 marks and shall be evaluated through internal assessment only.

The University examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

The University examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

For the University examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

## 12. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

For all theory and practical courses (including project work) the continuous assessment shall be for a maximum of 20 marks. The above continuous assessment shall be awarded as per the procedure given below:

**Theory Courses**

Three tests each carrying 100 marks shall be conducted during the semester by the Department / College concerned. The total marks obtained in all tests put together out of 300, shall be proportionately reduced for 20 marks and rounded to the nearest integer (This also implies equal weightage to all the three tests).

**Laboratory Courses**

The maximum marks for Internal Assessment shall be 20 in case of practical courses. Every practical exercise / experiment shall be evaluated based on conduct of experiment / exercise and records maintained. There shall be at least one test. The criteria for arriving at the Internal Assessment marks of 20 is as follows: 75 marks shall be awarded for successful completion of all the prescribed experiments done in the Laboratory and 25 marks for the test. The total mark shall be reduced to 20 and rounded to the nearest integer.

**Theory Courses with Laboratory Component**

If there is a theory course with Laboratory component, there shall be three tests: the first two tests (each 100 marks) will be from theory portions and the third test (maximum mark 100) will be for laboratory component. The sum of marks of first two tests shall be reduced to 60 marks and the third test mark shall be reduced to 40 marks. The sum of these 100 marks may then be arrived at for 20 and rounded to the nearest integer.

**Project Work**

Project work may be allotted to a single student or to a group of students not exceeding 4 per group.The Head of the Institutions shall constitute a review committee for project work for each branch of study. There shall be three reviews during the semester by the review committee. The student shall make presentation on the progress made by him / her before the committee. The total marks obtained in the three reviews shall be reduced for 20 marks and rounded to the nearest integer (as per the scheme given in 12.4.1).

The project report shall carry a maximum 30 marks. The project report shall be submitted as per the approved guidelines as given by Director, Academic Courses. Same mark shall be awarded to every student within the project group for the project report. The viva-voce examination shall carry 50 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination.

| Review I | Review II | Review III | End semester Examinations | | | | |
|---|---|---|---|---|---|---|---|
| | | | Thesis Submission (30) | | Viva-Voce (50) | | |
| 5 | 7.5 | 7.5 | Internal | External | Internal | External | Supervisor |
| | | | 15 | 15 | 15 | 20 | 15 |

If a candidate fails to submit the project report on or before the specified deadline, he/ she is deemed to have failed in the Project Work and shall re-register for the same in a subsequent semester.

**Other Employability Enhancement Courses**

(a) The seminar / Case study is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by Head of the Institution will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

(b) The Industrial / Practical Training, Summer Project, Internship, shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief

report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. The certificates (issued by the organization) submitted by the students shall be attached to the mark list sent by the Head of the Institution to the Controller of Examinations.

**Assessment for Value Added Course**

The one / two credit course shall carry 100 marks and shall be evaluated through continuous assessments only. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior Faculty member nominated by the Head of the Institution shall monitor the evaluation process. The list of students along with the marks and the grades earned may be forwarded to the Controller of Examinations for appropriate action at least one month before the commencement of End Semester Examinations.

**Assessment for Online Courses**

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. This online course of 3 credits can be considered instead of one elective course. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Anna University. The course shall be evaluated through the End Semester Examination only conducted by Controller of Examinations, Anna University.

Internal marks approved by the Head of the Institution shall be displayed by the respective HODs within 5 days from the last working day.

**Attendance Record**

Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years). The University or any inspection team appointed by the University may verify the records of attendance and assessment of both current and previous semesters.

**13. Requirements for Appearing for University Examinations**

A candidate shall normally be permitted to appear for the University Examinations for all the courses registered in the current semester (vide clause 6) if he/she has satisfied the semester completion requirements (subject to Clause 7).

A candidate who has already appeared for any subject in a semester and passed the examination is not entitled to reappear in the same subject for improvement of grades.

**14. PASSING REQUIREMENTS**

A candidate who secures not less than 50% of total marks prescribed for the course [Internal Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits. This is applicable for both theory and practical courses (including project work).

If a student fails to secure a pass in theory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters and their internal marks shall be carried over for the above mentioned period of three consecutive semesters. If a student fails to secure a pass in a course even after three consecutive arrear attempts, the student has to redo the course in the semester in which it is offered along with regular students.

That is, the students should have successfully completed the courses of (n minus 4)th semester to register for courses in nth semester.

Based on the above, the following prerequisites shall be followed for completing the degree programme:

i. To enter into Semester V, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.

ii. To enter into Semester VI, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.

iii. To enter into Semester VII, the student should have no arrear in Semester III. Failing which the student shall redo the Semester III course/courses along with the regular students.

iv. To enter into Semester VIII, the student should have no arrear in Semester IV. Failing which the student shall redo the Semester IV course/courses along with the regular students.

In case, if he/she has not successfully completed all the courses of semester V at the end of semester VIII, he/she shall redo the Semester V courses along with regular students. For the subsequent semesters of VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

**NOTE:**

- The students who are admitted in 2017-2018 and 2018 – 2019 are permitted to appear for arrears upto VI semesters and will be allowed to move to VII semester only on completion of all the courses in the I semester.

  In addition the following prerequisites shall be followed for completing the degree programme.

  i. To enter into Semester VII, the student should have no arrear in Semester I. Failing which the student shall redo the Semester I course/courses along with the regular students.

  ii. To enter into Semester VIII, the student should have no arrear in Semester II. Failing which the student shall redo the Semester II course/courses along with the regular students.

  In case, if he/she has not successfully completed all the courses of semester III at the end of semester VIII, he/she shall redo the Semester III courses along with regular students. For the subsequent semesters of IV, V, VI, VII and VIII, the same procedure shall be followed, subject to the maximum permissible period for this programme.

  If a student fails to secure a pass in a laboratory course, the student shall register for the course again, when offered next.

If a student fails to secure a pass in project work, the student shall register for the course again, when offered next.

The passing requirement for the courses which are assessed only through purely internal assessment (EEC courses except project work), is 50% of the internal assessment (continuous assessment) marks only.

A student can apply for revaluation of the student's semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee along with prescribed application to the COE through the Head of the Institution. The COE will arrange for the revaluation and the results will be intimated to the student concerned through the Head of the Institution. Revaluation is not permitted for laboratory course and project work.

## 15. AWARD OF LETTER GRADES

All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

| Letter Grade | Grade Points | Marks Range |
|---|---|---|
| O (Outstanding) | 10 | 91 - 100 |
| A + (Excellent) | 9 | 81 - 90 |
| A (Very Good) | 8 | 71 – 80 |
| B + (Good) | 7 | 61 – 70 |
| B (Average) | 6 | 50 - 60 |
| RA | 0 | <50 |
| SA (Shortage of Attendance) | 0 | |
| W | 0 | |

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+","B".

SA' denotes shortage of attendance (as per clause 7.3) and hence prevention from writing the end semester examinations. 'SA' will appear only in the result sheet.

"RA" denotes that the student has failed to pass in that course. "W" denotes withdrawal from the exam for the particular course. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet). In both cases the student has to earn Continuous Assessment marks and appear for the End Semester Examinations.

If the grade W is given to course, the attendance requirement need not be satisfied.If the grade RA is given to a core theory course, the attendance requirement need not be satisfied, but if the grade RA is given to a Laboratory Course/ Project work / Seminar and any other EEC course, the attendance requirements (vide clause 7) should be satisfied.

For the Co-curricular activities such as National Cadet Corps (NCC)/ National Service Scheme (NSS) / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme. However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. A satisfactory grade in the above co-curricular activities is compulsory for the award of degree.

The grades O, A+, A, B+, B obtained for the one credit course shall figure in the Mark sheet under the title 'Value Added Courses'. The Courses for which the grades are RA, SA will not figure in the mark sheet.

**GRADE SHEET**

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied
- The list of courses enrolled during the semester 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 for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester.

CGPA will be calculated in a similar manner, considering all the courses registered from first semester. RA grades will be excluded for calculating GPA and CGPA.

$$\text{GPA / CGPA} = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

where $C_i$ is the number of Credits assigned to the course

$GP_i$ is the point corresponding to the grade obtained for each course

n is number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

**16 ELIGIBILITY FOR THE AWARD OF THE DEGREE**

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters / (10 Semesters for B.E. Mechanical Engineering (Sandwich)) within a maximum period of 7 years (9 years in case of B.E. Mechanical Engineering (Sandwich) and 6 years in the case of Lateral Entry) reckoned from the commencement of the first (third in the case of Lateral Entry) semester to which the candidate was admitted.

iii. Successfully passed any additional courses prescribed by the Director, Academic Courses whenever readmitted under regulations R-2017 (vide clause 18.3)

iv. Successfully completed the NCC / NSS / NSO / YRC requirements.

v. No disciplinary action pending against the student.

vi. The award of Degree must have been approved by the Syndicate of the University.

**Classification of the Degree Awarded**

First Class With Distinction

A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) in the student's First Appearance within five years (Six years in the case of Mechanical (Sandwich) and Four years in the case of Lateral Entry). Withdrawal from examination (vide Clause 17) will not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50.
- One year authorized break of study (if availed of) is included in the five years (Six years in the case of Mechanical (Sandwich) and four years in the case of lateral entry) for award of First class with Distinction.
- Should NOT have been prevented from writing end semester examination due to lack of attendance in any semester.

**First Class:**

A student who satisfies the following conditions shall be declared to have passed the examination in First class:

* Should have passed the examination in all the courses of all eight semesters (10 Semesters in case of Mechanical (Sandwich) and 6 semesters in the case of Lateral Entry) within Six years. (Seven years in case of Mechanical (Sandwich) and Five years in the case of Lateral Entry)
* One year authorized break of study (if availed of) or prevention from writing the End Semester examination due to lack of attendance (if applicable) is included in the duration of six years (Seven years in case of Mechanical (Sandwich) and five years in the case of lateral entry) for award of First class
* Should have secured a CGPA of not less than 7.00.

**SECOND CLASS:**

All other students (not covered in clauses 16.2.1 and 16.2.2) who qualify for the award of the degree (vide Clause 16.1) shall be declared to have passed the examination in Second Class.

A candidate who is absent in end semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification. (subject to clause 17 and 18)

**Photocopy / Revaluation**

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institutions. The answer script is to be valued and justified by a faculty member, who handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institutions. Revaluation is not permitted for practical courses and for project work.

A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

**Review**

Candidates not satisfied with Revaluation can apply for Review of his/ her examination Answer paper in a theory course, within the prescribed date on payment of a prescribed fee through proper application to Controller of Examination through the Head of the Institution.

Candidates applying for Revaluation only are eligible to apply for Review.

## 17. PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

A student may, for valid reasons, (medically unfit / unexpected family situations / sports approved by Chairman, sports board and HOD) be granted permission to withdraw from appearing for the end semester examination in any course or courses in ANY ONE of the semester examinations during the entire duration of the degree programme. The application shall be sent to Director, Student Affairs through the Head of the Institutions with required documents.

Withdrawal application is valid if the student is otherwise eligible to write the examination (Clause 7) and if it is made within TEN days prior to the commencement of the examination in that course or courses and recommended by the Head of the Institution and approved by the Controller of Examinations.

Notwithstanding the requirement of mandatory 10 days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

In case of withdrawal from a course / courses (Clause 13) the course will figure both in Marks Sheet as well as in Result Sheet. Withdrawal essentially requires the student to register for the course/courses The student has to register for the course, fulfill the attendance requirements (vide clause 7), earn continuous assessment marks and attend the end semester examination. However, withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

Withdrawal is permitted for the end semester examinations in the final semester only if the period of study the student concerned does not exceed 5 years as per clause 16.2.1.

## 18. PROVISION FOR AUTHORISED BREAK OF STUDY

A student is permitted to go on break of study for a maximum period of one year as a single spell.

Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the Director, Student Affairs in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme.

The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Director, Academic Courses in the prescribed format through Head of the Institution at the beginning of the readmitted semester itself for prescribing additional courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

The authorized break of study would not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 16.2).

The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

If any student is prevented for want of required attendance, the period of prevention shall not be considered as authorized 'Break of Study' (Clause 18.1)

**19. DISCIPLINE**

Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University / College. The Head of Institution shall constitute a disciplinary committee consisting of Head of Institution, Two Heads of Department of which one should be from the faculty of the student, to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval. In case of any serious disciplinary action which leads to suspension or dismissal, then a committee shall be constituted including one representative from Anna University, Chennai. In this regard, the member will be nominated by the University on getting information from the Head of the Institution.

If a student indulges in malpractice in any of the University / internal examination he / she shall be liable for punitive action as prescribed by the University from time to time.

**20. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI**

The University may from time to time revise, amend or change the Regulations, Curriculum, Syllabus and scheme of examinations through the Academic Council with the approval of Syndicate.

**SEMESTER I**

| SI. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | Page No. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | HS8151 | Communicative English | HS | 4 | 4 | 0 | 0 | 4 | 25 |
| 2. | MA8151 | Engineering Mathematics - I | BS | 4 | 4 | 0 | 0 | 4 | 27 |
| 3. | PH8151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 | 29 |
| 4. | CY8151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 | 31 |
| 5. | GE8151 | Problem Solving and Python Programming | ES | 3 | 3 | 0 | 0 | 3 | 33 |
| 6. | GE8152 | Engineering Graphics | ES | 6 | 2 | 0 | 4 | 4 | 35 |
| **PRACTICALS** | | | | | | | | | |
| 7. | GE8161 | Problem Solving and Python Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 | 38 |
| 8. | BS8161 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 | 39 |
| **Total** | | | | **31** | **19** | **0** | **12** | **25** | |

**SEMESTER II**

| SI. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | Page No. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | HS8251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 | 41 |
| 2. | MA8251 | Engineering Mathematics - II | BS | 4 | 4 | 0 | 0 | 4 | 43 |
| 3. | PH8252 | Physics for Information Science | BS | 3 | 3 | 0 | 0 | 3 | 45 |
| 4. | BE8255 | Basic Electrical, Electronics and Measurement Engineering | ES | 3 | 3 | 0 | 0 | 3 | 47 |
| 5. | GE8291 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 | 49 |
| 6. | CS8251 | Programming in C | PC | 3 | 3 | 0 | 0 | 3 | 51 |
| **PRACTICALS** | | | | | | | | | |
| 7. | GE8261 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 | 53 |
| 8. | CS8261 | C Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 55 |
| **Total** | | | | **28** | **20** | **0** | **8** | **24** | |

**SEMESTER III**

| SI. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | MA8351 | Discrete Mathematics | BS | 4 | 4 | 0 | 0 | 4 | 57 |
| 2. | CS8351 | Digital Principles and System Design | ES | 4 | 4 | 0 | 0 | 4 | 59 |
| 3. | CS8391 | Data Structures | PC | 3 | 3 | 0 | 0 | 3 | 61 |
| 4. | CS8392 | Object Oriented Programming | PC | 3 | 3 | 0 | 0 | 3 | 63 |
| 5. | EC8395 | Communication Engineering | ES | 3 | 3 | 0 | 0 | 3 | 65 |
| **PRACTICALS** | | | | | | | | | |
| 6. | CS8381 | Data Structures Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 67 |
| 7. | CS8383 | Object Oriented Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 68 |
| 8. | CS8382 | Digital Systems Laboratory | ES | 4 | 0 | 0 | 4 | 2 | 70 |
| 9. | HS8381 | Interpersonal Skills/Listening &Speaking | EEC | 2 | 0 | 0 | 2 | 1 | 71 |
| **Total** | | | | **31** | **17** | **0** | **14** | **24** | |

**SEMESTER IV**

| SI. No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | MA8402 | Probability and Queueing Theory | BS | 4 | 4 | 0 | 0 | 4 | 73 |
| 2. | CS8491 | Computer Architecture | PC | 3 | 3 | 0 | 0 | 3 | 75 |
| 3. | CS8492 | Database Management Systems | PC | 3 | 3 | 0 | 0 | 3 | 77 |
| 4. | CS8451 | Design and Analysis of Algorithms | PC | 3 | 3 | 0 | 0 | 3 | 79 |
| 5. | CS8493 | Operating Systems | PC | 3 | 3 | 0 | 0 | 3 | 81 |
| 6. | CS8494 | Software Engineering | PC | 3 | 3 | 0 | 0 | 3 | 83 |
| **PRACTICALS** | | | | | | | | | |
| 7. | CS8481 | Database Management Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 85 |
| 8. | CS8461 | Operating Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 86 |
| 9. | HS8461 | Advanced Reading and Writing | EEC | 2 | 0 | 0 | 2 | 1 | 87 |
| **Total** | | | | **29** | **19** | **0** | **10** | **24** | |

**SEMESTER V**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | MA8551 | Algebra and Number Theory | BS | 4 | 4 | 0 | 0 | 4 | 89 |
| 2. | CS8591 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 | 91 |
| 3. | EC8691 | Microprocessors and Microcontrollers | PC | 3 | 3 | 0 | 0 | 3 | 93 |
| 4. | CS8501 | Theory of Computation | PC | 3 | 3 | 0 | 0 | 3 | 95 |
| 5. | CS8592 | Object Oriented Analysis and Design | PC | 3 | 3 | 0 | 0 | 3 | 97 |
| 6. | | Open Elective I | OE | 3 | 3 | 0 | 0 | 3 | |
| **PRACTICALS** | | | | | | | | | |
| 7. | EC8681 | Microprocessors and Microcontrollers Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 99 |
| 8. | CS8582 | Object Oriented Analysis and Design Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 100 |
| 9. | CS8581 | Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 102 |
| **Total** | | | | **31** | **19** | **0** | **12** | **25** | |

**SEMESTER VI**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | CS8651 | Internet Programming | PC | 3 | 3 | 0 | 0 | 3 | 103 |
| 2. | CS8691 | Artificial Intelligence | PC | 3 | 3 | 0 | 0 | 3 | 105 |
| 3. | CS8601 | Mobile Computing | PC | 3 | 3 | 0 | 0 | 3 | 107 |
| 4. | CS8602 | Compiler Design | PC | 5 | 3 | 0 | 2 | 4 | 109 |
| 5. | CS8603 | Distributed Systems | PC | 3 | 3 | 0 | 0 | 3 | 111 |
| 6. | | Professional Elective I | PE | 3 | 3 | 0 | 0 | 3 | |
| **PRACTICALS** | | | | | | | | | |
| 7. | CS8661 | Internet Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 113 |
| 8. | CS8662 | Mobile Application Development Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 115 |
| 9. | CS8611 | Mini Project | EEC | 2 | 0 | 0 | 2 | 1 | |
| 10. | HS8581 | Professional Communication | EEC | 2 | 0 | 0 | 2 | 1 | 116 |
| **Total** | | | | **32** | **18** | **0** | **14** | **25** | |

**SEMESTER VII**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | MG8591 | Principles of Management | HS | 3 | 3 | 0 | 0 | 3 | 118 |
| 2. | CS8792 | Cryptography and Network Security | PC | 3 | 3 | 0 | 0 | 3 | 120 |
| 3. | CS8791 | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 | 122 |
| 4. | | Open Elective II | OE | 3 | 3 | 0 | 0 | 3 | |
| 5. | | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 | |
| 6. | | Profession al Elective III | PE | 3 | 3 | 0 | 0 | 3 | |
| **PRACTICALS** | | | | | | | | | |
| 7. | CS8711 | Cloud Computing Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 124 |
| 8. | IT8761 | Security Laboratory | PC | 4 | 0 | 0 | 4 | 2 | 125 |
| **Total** | | | | **26** | **18** | **0** | **8** | **22** | |

**SEMESTER VIII**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | | |
| 1. | | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 | |
| 2. | | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 | |
| **PRACTICALS** | | | | | | | | | |
| 3. | CS8811 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 | 126 |
| **Total** | | | | **26** | **6** | **0** | **20** | **16** | |

## HUMANITIES AND SOCIAL SCIENCES (HS)

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | HS8151 | Communicative English | HS | 4 | 4 | 0 | 0 | 4 |
| 2. | HS8251 | Technical English | HS | 4 | 4 | 0 | 0 | 4 |
| 3. | GE8291 | Environmental Science and Engineering | HS | 3 | 3 | 0 | 0 | 3 |
| 4. | MG8591 | Principles of Management | HS | 3 | 3 | 0 | 0 | 3 |

## BASIC SCIENCES (BS)

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | MA8151 | Engineering Mathematics I | BS | 4 | 4 | 0 | 0 | 4 |
| 2. | PH8151 | Engineering Physics | BS | 3 | 3 | 0 | 0 | 3 |
| 3. | CY8151 | Engineering Chemistry | BS | 3 | 3 | 0 | 0 | 3 |
| 4. | BS8161 | Physics and Chemistry Laboratory | BS | 4 | 0 | 0 | 4 | 2 |
| 5. | MA8251 | Engineering Mathematics II | BS | 4 | 4 | 0 | 0 | 4 |
| 6. | PH8252 | Physics for Information Science | BS | 3 | 3 | 0 | 0 | 3 |
| 7. | MA8351 | Discrete Mathematics | BS | 4 | 4 | 0 | 0 | 4 |
| 8. | MA8402 | Probability and Queueing Theory | BS | 4 | 4 | 0 | 0 | 4 |
| 9. | MA8551 | Algebra and Number Theory | BS | 4 | 4 | 0 | 0 | 4 |

## ENGINEERING SCIENCES (ES)

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | GE8151 | Problem Solving and Python Programming | ES | 3 | 3 | 0 | 0 | 3 |
| 2. | GE8152 | Engineering Graphics | ES | 6 | 2 | 0 | 4 | 4 |
| 3. | GE8161 | Problem Solving and Python Programming Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 4. | BE8255 | Basic Electrical, Electronics and Measurement Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 5. | GE8261 | Engineering Practices Laboratory | ES | 4 | 0 | 0 | 4 | 2 |
| 6. | CS8351 | Digital Principles and System Design | ES | 4 | 4 | 0 | 0 | 4 |
| 7. | EC8395 | Communication Engineering | ES | 3 | 3 | 0 | 0 | 3 |
| 8. | CS8382 | Digital Systems Laboratory | ES | 4 | 0 | 0 | 4 | 2 |

## PROFESSIONAL CORE (PC)

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | CS8251 | Programming in C | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | CS8261 | C Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 3. | CS8391 | Data Structures | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | CS8392 | Object Oriented Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | CS8381 | Data Structures Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 6. | CS8383 | Object Oriented Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 7. | CS8491 | Computer Architecture | PC | 3 | 3 | 0 | 0 | 3 |
| 8. | CS8492 | Database Management Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 9. | CS8451 | Design and Analysis of Algorithms | PC | 3 | 3 | 0 | 0 | 3 |
| 10. | CS8493 | Operating Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 11. | CS8494 | Software Engineering | PC | 3 | 3 | 0 | 0 | 3 |
| 12. | CS8481 | Database Management Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 13. | CS8461 | Operating Systems Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 14. | CS8591 | Computer Networks | PC | 3 | 3 | 0 | 0 | 3 |
| 15. | EC8691 | Microprocessors and Microcontrollers | PC | 3 | 3 | 0 | 0 | 3 |
| 16. | CS8501 | Theory of Computation | PC | 3 | 3 | 0 | 0 | 3 |
| 17. | CS8592 | Object Oriented Analysis and Design | PC | 3 | 3 | 0 | 0 | 3 |
| 18. | EC8681 | Microprocessors and Microcontrollers Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 19. | CS8582 | Object Oriented Analysis and Design Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 20. | CS8581 | Networks Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 21. | CS8651 | Internet Programming | PC | 3 | 3 | 0 | 0 | 3 |
| 22. | CS8691 | Artificial Intelligence | PC | 3 | 3 | 0 | 0 | 3 |
| 23. | CS8601 | Mobile Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 24. | CS8602 | Compiler Design | PC | 5 | 3 | 0 | 2 | 4 |
| 25. | CS8603 | Distributed Systems | PC | 3 | 3 | 0 | 0 | 3 |
| 26. | CS8661 | Internet Programming Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 27. | CS8662 | Mobile Application Development Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 28. | CS8792 | Cryptography and Network Security | PC | 3 | 3 | 0 | 0 | 3 |
| 29. | CS8791 | Cloud Computing | PC | 3 | 3 | 0 | 0 | 3 |
| 30. | CS8711 | Cloud Computing Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| 31. | IT8761 | Security Laboratory | PC | 4 | 0 | 0 | 4 | 2 |

**PROFESSIONAL ELECTIVES (PE)**

**SEMESTER VI ELECTIVE - I**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | CS8075 | Data Warehousing and Data Mining | PE | 3 | 3 | 0 | 0 | 3 | 127 |
| 2. | IT8076 | Software Testing | PE | 3 | 3 | 0 | 0 | 3 | 128 |
| 3. | IT8072 | Embedded Systems | PE | 3 | 3 | 0 | 0 | 3 | 129 |
| 4. | CS8072 | Agile Methodologies | PE | 3 | 3 | 0 | 0 | 3 | 130 |
| 5. | CS8077 | Graph Theory and Applications- | PE | 3 | 3 | 0 | 0 | 3 | 132 |
| 6. | IT8071 | Digital Signal Processing | PE | 3 | 3 | 0 | 0 | 3 | 133 |
| 7. | GE8075 | Intellectual Property Rights | PE | 3 | 3 | 0 | 0 | 3 | 134 |

**SEMESTER VII ELECTIVE – II**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | CS8091 | Big Data Analytics | PE | 3 | 3 | 0 | 0 | 3 | 135 |
| 2. | CS8082 | Machine Learning Techniques | PE | 3 | 3 | 0 | 0 | 3 | 136 |
| 3. | CS8092 | Computer Graphics and Multimedia | PE | 3 | 3 | 0 | 0 | 3 | 137 |
| 4. | IT8075 | Software Project Management | PE | 3 | 3 | 0 | 0 | 3 | 139 |
| 5. | CS8081 | Internet of Things | PE | 3 | 3 | 0 | 0 | 3 | 140 |
| 6. | IT8074 | Service Oriented Architecture | PE | 3 | 3 | 0 | 0 | 3 | 141 |
| 7. | GE8077 | Total Quality Management | PE | 3 | 3 | 0 | 0 | 3 | 142 |

**SEMESTER VII ELECTIVE - III**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | CS8083 | Multi-core Architectures and Programming | PE | 3 | 3 | 0 | 0 | 3 | 143 |
| 2. | CS8079 | Human Computer Interaction | PE | 3 | 3 | 0 | 0 | 3 | 144 |
| 3. | CS8073 | C# and .Net Programming | PE | 3 | 3 | 0 | 0 | 3 | 145 |
| 4. | CS8088 | Wireless Adhoc and Sensor Networks | PE | 3 | 3 | 0 | 0 | 3 | 147 |
| 5. | CS8071 | Advanced Topics on Databases | PE | 3 | 3 | 0 | 0 | 3 | 148 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6. | GE8072 | Foundation Skills in Integrated Product Development | PE | 3 | 3 | 0 | 0 | 3 | 149 |
| 7. | GE8074 | Human Rights | PE | 3 | 3 | 0 | 0 | 3 | 151 |
| 8. | GE8071 | Disaster Management | PE | 3 | 3 | 0 | 0 | 3 | 151 |

**SEMESTER VIII ELECTIVE – IV**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | EC8093 | Digital Image Processing | PE | 3 | 3 | 0 | 0 | 3 | 153 |
| 2. | CS8085 | Social Network Analysis | PE | 3 | 3 | 0 | 0 | 3 | 154 |
| 3. | IT8073 | Information Security | PE | 3 | 3 | 0 | 0 | 3 | 155 |
| 4. | CS8087 | Software Defined Networks | PE | 3 | 3 | 0 | 0 | 3 | 156 |
| 5. | CS8074 | Cyber Forensics | PE | 3 | 3 | 0 | 0 | 3 | 157 |
| 6. | CS8086 | Soft Computing | PE | 3 | 3 | 0 | 0 | 3 | 158 |
| 7. | GE8076 | Professional Ethics in Engineering | PE | 3 | 3 | 0 | 0 | 3 | 159 |

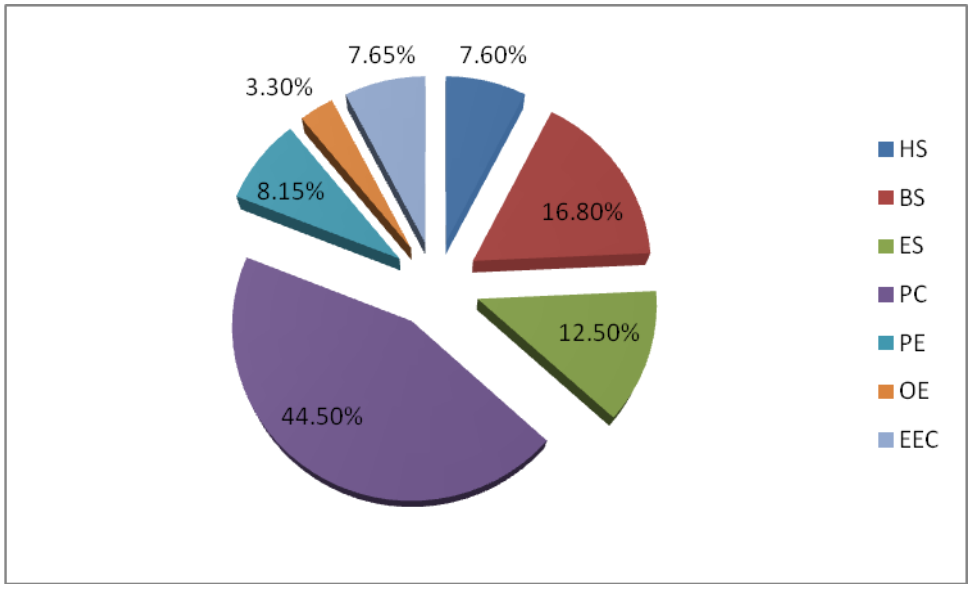
**SEMESTER VIII ELECTIVE - V**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C | PAGE NO. |
|---|---|---|---|---|---|---|---|---|---|
| 1. | CS8080 | Information Retrieval Techniques | PE | 3 | 3 | 0 | 0 | 3 | 161 |
| 2. | CS8078 | Green Computing | PE | 3 | 3 | 0 | 0 | 3 | 162 |
| 3. | CS8076 | GPU Architecture and Programming | PE | 3 | 3 | 0 | 0 | 3 | 163 |
| 4. | CS8084 | Natural Language Processing | PE | 3 | 3 | 0 | 0 | 3 | 164 |
| 5. | CS8001 | Parallel Algorithms | PE | 3 | 3 | 0 | 0 | 3 | 165 |
| 6. | IT8077 | Speech Processing | PE | 3 | 3 | 0 | 0 | 3 | 166 |
| 7. | GE8073 | Fundamentals of Nano Science | PE | 3 | 3 | 0 | 0 | 3 | 167 |

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

| SI.No | COURSE CODE | COURSE TITLE | CATEGORY | CONTACT PERIODS | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | HS8381 | Interpersonal Skills/Listening & Speaking | EEC | 2 | 0 | 0 | 2 | 1 |
| 2. | HS8461 | Advanced Reading and Writing | EEC | 2 | 0 | 0 | 2 | 1 |
| 3. | CS8611 | Mini Project | EEC | 2 | 0 | 0 | 2 | 1 |
| 4. | CS8811 | Project Work | EEC | 20 | 0 | 0 | 20 | 10 |

| S. NO. | SUBJECT AREA | CREDITS AS PER SEMESTER | | | | | | | | CREDITS TOTAL | PERCENTAGE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1 | HS | 4 | 7 | | | | | 3 | | 14 | 7.60% |
| 2 | BS | 12 | 7 | 4 | 4 | 4 | | | | 31 | 16.8% |
| 3 | ES | 9 | 5 | 9 | | | | | | 23 | 12.5% |
| 4 | PC | | 5 | 10 | 19 | 18 | 20 | 10 | | 82 | 44.5% |
| 5 | PE | | | | | | 3 | 6 | 6 | 15 | 8.15% |
| 6 | OE | | | | | 3 | | 3 | | 6 | 3.3% |
| 7 | EEC | | | 1 | 1 | | 2 | | 10 | 14 | 7.65% |
| | Total | 25 | 24 | 24 | 24 | 25 | 25 | 22 | 16 | 185 | |
| 8 | Non credit / Mandatory | - | - | - | - | - | - | - | - | | |



**HS8151 COMMUNICATIVE ENGLISH L T P C 4 0 0 4**

**Course Objectives**

- To enable the students to listen and understand speeches in English
- To facilitate the acquisition of speaking skills in real life contexts
- To provide activities to enrich their vocabulary
- To reinforce through practice the importance of reading and writing skills for engineers

**UNIT I SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS 12**

Reading- short comprehension passages, practice in skimming-scanning and predicting- Writing- completing sentences- - developing hints. Listening- short texts- short formal and informal conversations. Speaking- introducing oneself - exchanging personal information- Language development- Wh- Questions- asking and answering-yes or no questions- parts of speech. Vocabulary development- prefixes- suffixes- articles.- countable/ uncountable nouns.

**UNIT II GENERAL READING AND FREE WRITING 12**

**Reading -** comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- **Writing** – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –**Listening**- telephonic conversations. **Speaking –** sharing information of a personal kind—greeting – taking leave- **Language development** – prepositions, conjunctions **Vocabulary development-** guessing meanings of words in context.

**UNIT III GRAMMAR AND LANGUAGE DEVELOPMENT 12**

Reading- short texts and longer passages (close reading) Writing- understanding text structure- use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

**UNIT IV READING AND LANGUAGE DEVELOPMENT 12**

Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email- Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one's friend- Language development- Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

**UNIT V EXTENDED WRITING 12**

Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks- conversations- Speaking – participating in conversations- short group conversations-Language development-modal verbs- present/ past perfect tense - Vocabulary development-collocations- fixed and semi-fixed expressions

**TOTAL: 60 PERIODS**

**Course Outcomes:**
At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Deploy** grammatical and vocabulary elements appropriately in writing short paragraphs and essays | Remembering |
| CO2 | **Interpret** content from a variety of texts to gain deeper understanding by using context clues | Understanding |
| CO3 | **Present** with clarity and precision essays, personal letters and emails | Understanding |
| CO4 | **Express** briefly and precisely ideas and opinions in speaking | Applying |
| CO5 | **Demonstrate** excellent verbal and non-verbal skills in group discussions | Applying |

**TEXT BOOKS:**


1. Board of Editors. Using English A Course book for Undergraduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015

2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.


**REFERENCES:**


1. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge,2011.
2. Means,L. Thomas and Elaine Langlois. English & Communication For Colleges. Cengage Learning ,USA: 2007
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011
5. Dutt P. Kiranmai and Rajeevan Geeta. Basic Communication Skills, Foundation Books: 2013


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | 1 | - | - | 1 | 3 | - | 3 | - | - |
| CO2 | - | - | - | - | - | 1 | - | - | 1 | 3 | - | 3 | - | - |
| CO3 | - | - | - | - | - | 1 | - | - | 1 | 3 | - | 3 | - | - |
| CO4 | - | - | - | - | - | 1 | - | - | 1 | 3 | - | 3 | - | - |
| CO5 | - | - | - | - | - | 1 | - | - | 1 | 3 | - | 3 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**MA8151 ENGINEERING MATHEMATICS - I L T P C 4 0 0 4**

**Course Objectives:**

- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**UNIT I DIFFERENTIAL CALCULUS 12**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules -Maxima and Minima of functions of one variable.

**UNIT II FUNCTIONS OF SEVERAL VARIABLES 12**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT III INTEGRAL CALCULUS 12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts,Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction,Integration of irrational functions - Improper integrals.

**UNIT IV MULTIPLE INTEGRALS 12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Areaenclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double andtriple integrals.

**UNIT V DIFFERENTIAL EQUATIONS 12**

Higher order linear differential equations with constant coefficients - Method of variation of parameters– Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differentialequations with constant coefficients - Method of undetermined coefficients.

**TOTAL : 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Differentiate functions usingthe limit and continuity concepts and find extreme values for functions of single variable. | Applying |
| CO2 | Calculatethe derivatives of functions of two variables and determine extreme values. | Applying |
| CO3 | Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts. | Applying |
| CO4 | Compute multiple integrals, area between curves and volume enclosed by surfaces. | Applying |
| CO5 | Solve second and higher order differential equations (upto fourth order with constant coefficients). | Applying |

**TEXT BOOKS:**

1. GrewalB.S.,HigherEngineeringMathematics‖,KhannaPublishers,NewDelhi,43rdEdition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi,2015.[ For Units I & III - Sections1.1,2.2,2.3,2.5,2.7(Tangents problems only),2.8 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and7.8].

**REFERENCES:**

1. Anton, H, Bivens, I and Davis, S, "Calculus", Wiley, 10th Edition,2016.
2. JainR.K.andIyengarS.R.K., Advanced Engineering Mathematics‖,NarosaPublications, New Delhi, 3rd Edition, 2007.
3. Narayanan,S.andManicavachagomPillai,T.K.,-Calculus"VolumeIand II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press,2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India,2016.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**PH8151 ENGINEERING PHYSICS L T P C 3 0 0 3**

**Course Objectives**

- To be able to identify and analyze concepts involved in the mechanical and thermal properties of materials.
- To acquire skills allowing the student to identify different oscillatory motion and the knowledge about lasers, fiber optics and their applications.
- To acquaint the student with the knowledge of physics governing the behavior of electrons and their relevance in the development of various electron microscopes.
- To introduce basic concepts of solid state physics that determine the properties of materials

**UNIT I PROPERTIES OF MATTER 9**

Elasticity – Stress-strain diagram and its uses – factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment – bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders – stress due to bending in beams.

**UNIT II WAVES AND FIBER OPTICS 9**

Oscillatory motion – forced and damped oscillations: differential equation and its solution – plane progressive waves – wave equation. Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fibre optic sensors: pressure and displacement.

**UNIT III THERMAL PHYSICS 9**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints – bimetallic strips – thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity – Forbe's and Lee's disc method: theory and experiment – conduction through compound media (series and parallel – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

**UNIT IV QUANTUM PHYSICS 9**

Black body radiation – Plank's theory (derivation) – Compton effect: theory and experimental verification wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrodinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box – tunneling (qualitative) – scanning tunneling microscope.

**UNIT V CRYSTAL PHYSICS 9**

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances – coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures – crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation – growth of single crystals: solution and melt growth techniques.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Compare** the elastic properties of different materials. | Understanding |
| CO2 | **Understand** the principle of LASER and fiber optic communication. | Understanding |

| | | |
|---|---|---|
| CO3 | **Explain** the thermal properties of solids and its engineering applications. | Understanding |
| CO4 | **Understand** the concepts of quantum physics to describe the behavior of electrons in electron microscope. | Understanding |
| CO5 | **Relate** the crystal structure to electrical, mechanical and optical properties of materials. | Understanding |

**TEXT BOOKS:**


1. Bhattacharya, D.K. & Poonam, T. – "Engineering Physics". Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. – "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. Pandey, B.K.& Chaturvedi, S. – "Engineering Physics". Cengage Learing India, 2012.


**REFERENCES:**


1. Halliday, D., Resnick, R. & Walker, J. _- "Principles of Physics". Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. – "Physics for Scientists and Engineers". Cengage Learing, 2010.
3. Tippler, P.A. & Mosca, G. – "Physics for Scientists and Engineers with Modern Physics". W.H. Freeman, 2007.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |
| CO4 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |
| CO5 | 2 | 1 | - | - | - | 2 | 1 | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CY8151 ENGINEERING CHEMISTRY L T P C 3 0 0 3**

**Course Objectives**

- To impart the basic knowledge about water quality, water treatment process and application of water treatment processes for domestic and industrial use.
- To understand the adsorption process and its use in pollution control.
- To study the fundamentals of phase rule and the preparation of different types of alloys and its use in different fields
- To imbibe the basic knowledge of fuels and assess its quality using different methods
- To categorize the different energy resources and their uses

**UNIT I WATER AND ITS TREATMENT 9**

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water - Reverse Osmosis.

**UNIT II SURFACE CHEMISTRY AND CATALYSIS 9**

Adsorption: Types of adsorption – adsorption of gases on solids – adsorption of solute from solutions – adsorption isotherms – Freundlich's adsorption isotherm – Langmuir's adsorption isotherm – contact theory – kinetics of surface reactions, unimolecular reactions, Langmuir - applications of adsorption on pollution abatement.Catalysis:Catalyst – types of catalysis – criteria – autocatalysis – catalytic poisoning and catalytic promoters - acid base catalysis – applications (catalytic convertor) – enzyme catalysis– Michaelis – Menten equation.

**UNIT III ALLOYS AND PHASE RULE 9**

Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel. Phase rule: Introduction, definition of terms with examples, one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system - Pattinson process.

**UNIT IV FUELS AND COMBUSTION 9**

Fuels: Introduction - classification of fuels - coal - analysis of coal (proximate and ultimate) - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - manufacture of synthetic petrol (Bergius process) - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol and biodiesel.Combustion of fuels: Introduction - calorific value - higher and lower calorific values- theoretical calculation of calorific value - ignition temperature - spontaneous ignition temperature - explosive range - flue gas analysis (ORSAT Method).

**UNIT V ENERGY SOURCES AND STORAGE DEVICES 9**

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – $H_2$-$O_2$ fuel cell, methanol oxygen fuel cell, SOFC and supercapacitors.

**TOTAL: 45 PERIODS**

**Course Outcomes:**
On successful completion of this course students will be able to :

| | | |
|---|---|---|
| CO1 | **Describe** the hardness of water samples and the various water treatment processes | **Understanding** |
| CO2 | **Explain** the different adsorption isotherms and catalysis | **Understanding** |
| CO3 | **Illustrate** the phase diagrams, alloys and the heat treatment processes | **Understanding** |
| CO4 | **Distinguish** the types of fuels and describe the manufacturing of synthetic fuels | **Understanding** |
| CO5 | **Discuss** the different renewable energy resources and the energy storage devices | **Understanding** |

**TEXT BOOKS:**


1. S. S. Dara and S. S. Umare, ―A Textbook of Engineering Chemistry‖, S. Chand & Company LTD, New Delhi, 2015
2. P. C. Jain and Monika Jain, ―Engineering Chemistry‖ Dhanpat Rai Publishing Company (P)LTD, New Delhi, 2015
3. S. Vairam, P. Kalyani and Suba Ramesh, ―Engineering Chemistry‖, Wiley India PVT, LTD,New Delhi, 2013.


**REFERENCES:**


1. Friedrich Emich, ―Engineering Chemistry‖, Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, ―Engineering Chemistry‖, Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, ―Engineering Chemistry-Fundamentals and Applications‖, Cambridge University Press, Delhi, 2015.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | 2 | 2 | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 2 | 1 | - | - | - | 2 | - | - | - | - | - | - | - | - |
| CO5 | 2 | 1 | - | - | - | 2 | 2 | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**GE8151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C 3 0 0 3**

**Course Objectives**

- To introduce the need and explore the concepts of programming
- To expose the appropriate constructs and data structure of the Python programming language for any problem statement.
- To implement code reusability by modularizing and packaging the application

**UNIT I ALGORITHMIC PROBLEM SOLVING 9**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion) . Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

**UNIT II DATA, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT III CONTROL FLOW, FUNCTIONS 9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

**UNIT IV LISTS, TUPLES, DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

**UNIT V FILES, MODULES, PACKAGES 9**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

**TOTAL : 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the usage of basic programming constructs with suitable examples | Understanding |
| CO2 | Design the algorithmic solutions to simple computational problems | Applying |
| CO3 | Develop Python programs using conditional, loops and data structures | Applying |
| CO4 | Create functions modules and packages for real time programming problems and demonstrate the concept of code reusability | Applying |
| CO5 | Demonstrate python applications which reads, writes and process python files | Applying |

**TEXT BOOKS:**


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


**REFERENCES:**


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


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | -- | -- | 2 | -- | -- | 1 | -- | -- | -- | -- | 3 | 2 |
| **CO2** | 3 | 2 | -- | 1 | 3 | -- | -- | 2 | -- | 2 | -- | 2 | 3 | 2 |
| **CO3** | 3 | 2 | -- | 1 | 3 | -- | -- | 2 | 2 | 2 | -- | 3 | 3 | 2 |
| **CO4** | 3 | 2 | -- | 1 | 3 | -- | -- | 2 | 2 | 2 | -- | 3 | 3 | 2 |
| **CO5** | 3 | 2 | -- | 1 | 3 | -- | -- | 2 | 2 | 2 | -- | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**GE8152 ENGINEERING GRAPHICS L T P C 2 0 4 4**

**Course Objectives**

- To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose them to existing national standards related to technical drawings.

**CONCEPTS AND CONVENTIONS (Not for Examination) 1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

**UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS 5+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method .

**TOTAL: 90 PERIODS**

**Course Outcomes:**

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

| | | |
|---|---|---|
| CO1 | **Prepare** orthographic views of typical components from pictorial drawings | Applying |
| CO2 | **Draw** the orthographic projections of points, lines, planes and solids | Applying |
| CO3 | **Draw** the orthographic projections of sectioned solids and true shape of the sections | Applying |
| CO4 | **Develop** lateral surfaces of the cut solids and solids with holes | Applying |
| CO5 | **Visualise** and **draw** the isometric and perspective projections of the simple solids, cut solids and combination of the solids | Applying |
| CO6 | **Construct** conic sections like ellipse, parabola & hyperbola and special curves like cycloid, epicycloid, hypocycloid and involute | Applying |

**TEXT BOOKS:**


1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.


**REFERENCES:**


1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.


**Publication of Bureau of Indian Standards**:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

**Special points applicable to University Examinations on Engineering Graphics:**

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - |
| CO2 | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | 2 | - | - | - | - |
| CO4 | 3 | 2 | 1 | 1 | - | - | - | - | 2 | 2 | - | - | - | - |
| CO5 | 3 | 2 | - | 1 | - | - | - | - | 2 | 2 | - | - | - | - |
| CO6 | 3 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**GE8161 Problem solving and Python Programming Laboratory L T P C 0 0 4 2**

**Course Objectives:**

- Demonstrate the use of basic Python Programming constructs and Data structures.
- Present an overview of debugging and validating the programs written in Python.

**LIST OF PROGRAMS:**

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

**Course Outcomes:**
At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Develop , Implement and validate the python programs using various constructs, modules and packages | Applying |
| CO2 | Develop, Implement and validate gaming programs using Pygame. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| **CO/ PO/ PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 3 | 1 | - | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | 3 | 1 | - | 1 | 2 | 1 | 1 | 2 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**BS8161 PHYSICS AND CHEMISTRY LABORATORY L T P C 0 0 4 2**

**Course Objective**

- To understand the fundamentals of interference and diffraction.
- To demonstrate the principles of elasticity and thermal properties for engineering applications.

**LIST OF EXPERIMENTS:(Any 5 Experiments)**

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
   (a) Determination of wavelength and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber
3. Determination of thermal conductivity of a bad conductor – Lee's Disc method
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
5. Determination of wavelength of mercury spectrum – spectrometer grating
6. Determination of band gap of a semiconductor
7. Determination of thickness of a thin wire – Air wedge method

**TOTAL : 30 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Determine the thickness of thin samples, wavelength of the prominent colors of the mercury spectrum and velocity of ultrasonic waves | Applying |
| CO2 | Determine the Young's modulus of the material and thermal conductivity of poor conductor | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO / PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | 3 | 2 | 2 | | 2 | | |
| CO2 | 3 | 2 | | | | | | 3 | 2 | 2 | | 2 | | |

1: **L**ow 2: **M**edium 3: **H**igh

**BS8161 CHEMISTRY LABORATORY**

**Course objectives**

- To train students in the experimental methods of evaluating water quality parameters, the effluent content in sewage water, the assessment of corrosion rate in mild steel and estimation of metals.

**LIST OF EXPERIMENTS (Any SEVEN Experiments)**

1. Estimation of HCl using Na2CO3as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.
16. Conduct metric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

**Course Outcomes**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Demonstrate the measurement of water quality parameters in the given water sample | Applying |
| CO2 | Evaluate the acidity/ basicity content in the given water sample | Applying |
| CO3 | Estimate the metal ion content in different water samples in order to assess the portability of water | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 3 | | 3 | 2 | 2 | | 2 | - | - |
| CO2 | 3 | 2 | | | | 3 | | 3 | 2 | 2 | | 2 | - | - |
| CO3 | 3 | 2 | | | | 3 | | 3 | 2 | 2 | | 2 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**HS8251 TECHNICAL ENGLISH L T P C 4 0 0 4**

**Course Objectives**

- The required strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
- The felicity to write effective letters of applications and reports.
- Develop their speaking skills which help them use English to express their ideas, views and opinions in varied formal and informal contexts.
- Enhance their listening skill which will help them comprehend lectures and talks in their areas of specialisation.

**UNIT I INTRODUCTION TECHNICAL ENGLISH 12**

Listening- Listening to talks mostly of a scientific/technical nature and completing information-gap exercises- Speaking –Asking for and giving directions- Reading – reading short technical texts from journals- newspapers- Writing- purpose statements – extended definitions – issue- writing instructions – checklists-recommendations-Vocabulary Development- technical vocabulary-Language Development –subject verb agreement - compound words.

**UNIT II READING AND STUDY SKILLS 12**

Listening- Listening to longer technical talks and completing exercises based on them-Speaking – describing a process-Reading – reading longer technical texts- identifying the various transitions in a text- paragraphing- Writing- interpreting charts, graphs-Vocabulary Development - vocabulary used in formal letters/emails and reports Language Development impersonal passive voice, numerical adjectives.

**UNIT III TECHNICAL WRITING AND GRAMMAR 12**

Listening- Listening to classroom lectures/ talks on engineering/technology – Speaking - introduction to technical presentations- Reading – longer texts both general and technical,practice in speed reading; Writing-Describing a process, use of sequence words-Vocabulary Development-sequence words - Misspelled words. Language Development-embedded sentences.

**UNIT IV REPORT WRITING 12**

Listening- Listening to documentaries and making notes. Speaking – mechanics ofpresentations- Reading – reading for detailed comprehension- Writing- email etiquette-jobapplication – cover letter –Résumé preparation( via email and hard copy)- analytical essays andissue based essays-Vocabulary Development- finding suitable synonyms-paraphrasing-.Language Development- clauses- if conditionals.

**UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 12**

Listening- TED/Ink talks; Speaking –participating in a group discussion -Reading– reading and understanding technical articles Writing– Writing reports- minutes of a meeting-accident and survey-Vocabulary Development- verbal analogies Language Development-reported speech.

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Read and comprehend passages on different topics | Understanding |
| CO2 | Deploy grammatical and vocabulary elements appropriately and effectively | Understanding |
| CO3 | Prepare reports, job application, resumes, articles and formal letters | Applying |

| | | |
|---|---|---|
| CO4 | Explain various manufacturing processes, and interpret charts and graphs | Understanding |
| CO5 | Demonstrate good conversational skills and participate in group discussions | Applying |

**TEXT BOOKS:**


1. Board of editors. Fluency in English A Course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge
   University Press: New Delhi, 2016.


**REFERENCES:**


1. Booth-L. Diana, Project Work, Oxford University Press, Oxford: 2014.
2. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford: 2007
3. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
4. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges. Cengage Learning, USA: 2007
5. Raman, Meenakshi and Sharma, Sangeetha- Technical Communication Principles and Practice. Oxford University Press: New Delhi, 2014.
6. Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 2 | -- | 3 | | |
| CO2 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 2 | -- | 3 | | |
| CO3 | -- | -- | -- | -- | -- | 1 | -- | -- | 1 | 3 | -- | 3 | | |
| CO4 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 3 | -- | 3 | | |
| CO5 | -- | -- | -- | -- | -- | 1 | -- | -- | -- | 3 | -- | 3 | | |

1: **L**ow 2: **M**edium 3: **H**igh

**MA8251 ENGINEERING MATHEMATICS – II L T P C 4 0 0 4**

**Course Objectives:**

- To acquaint the student with the concepts of Vector Calculus and Laplace Transforms needed for solving problems that occur in all engineering disciplines.
- To introduce the concept of eigenvalues, eigenvectors and their applications.
- To impart the knowledge on analytic function, complex integration and their applications.

**UNIT I MATRICES 12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvaluesand Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of aquadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II VECTOR CALCULUS 12**

Gradient and directional derivative – Divergence and curl - Vector identities – Irrotational andSolenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curvedsurface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification andapplication in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTIONS 12**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polarcoordinates - Properties – Harmonic conjugates – Construction of analytic function – Conformalmapping – Mapping by functions $w=z+c, cz, 1/z, z^2$, - Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION 12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series– Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of realintegrals – Use of circular contour and semicircular contour.

**UNIT V LAPLACE TRANSFORMS 12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unitimpulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals –Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodicfunctions – Application to solution of linear second order ordinary differential equations with constantcoefficients.

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Reduce quadratic form into canonical formby orthogonal transformation. | Applying |
| CO2 | Compute integrals using Green's theorem, Stoke's theorem and Gauss divergence theorem. | Applying |
| CO3 | Construct analytic functions and describe conformal mappings for various regions in complex plane. | Applying |
| CO4 | Calculate real integrals using complex integral theorems. | Applying |
| CO5 | Solve ordinary differential equations with constant coefficients using Laplace transforms. | Applying |

**TEXT BOOKS:**

1. Grewal B.S., "Higher EngineeringMathematics",Khanna Publishers,NewDelhi, 43rd Edition,2014.
2. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

**REFERENCES:**

1. Bali N., GoyalM. andWatkins C., "Advanced Engineering Mathematics"‖,Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition,2009.
2. Jain R.K. and Iyengar S.R.K., " Advanced Engineering Mathematics",NarosaPublications, New Delhi , 3rd Edition,2007.
3. O'Neil,P.V., "Advanced Engineering Mathematics",CengageLearning India Pvt., Ltd, New Delhi,2007.
4. Sastry,S.S, "Engineering Mathematics",Vol.I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5. Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**PH8252 PHYSICS FOR INFORMATION SCIENCE L T P C 3 0 0 3**

**Course Objectives**

- To understand the essential principles of electron transport properties and semiconductor devices.
- To impart the knowledge of magnetic and optical properties of materials and devices for engineering applications.
- To acquaint the student with the optical properties of semiconductors to understand working of various electro optical devices.
- To introduce the basic concepts of nano structures and their applications and its application in nano devices.
-

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9**

Classical free electron theory -Expression for electrical conductivity –Thermal conductivity, expression -Wiedemann-Franz law–Success and failures -electrons in metals –Particle in a three dimensional box –degenerate states –Fermi -Dirac statistics –Density of energy states –Electron in periodic potential –Energy bands in solids–tight binding approximation -Electroneffective mass –concept of hole.

**UNIT II SEMICONDUCTOR PHYSICS 9**

Intrinsic Semiconductors –Energy band diagram–direct and indirect band gap semiconductors –Carrier concentration in intrinsic semiconductors –extrinsic semiconductors -Carrier concentration in N-type & P-type semiconductors–Variation of carrier concentration with temperature –variation of Fermi level with temperature and impurity concentration –Carrier transport in Semiconductor: random motion, drift, mobility and diffusion –Hall effect and devices –Ohmic contacts –Schottky diode.

**UNIT III MAGNETIC PROPERTIES OF MATERIALS 9**

Magnetic dipole moment –atomic magnetic moments-magnetic permeability and susceptibility -Magnetic material classification: diamagnetism –paramagnetism –ferromagnetism –antiferromagnetism –ferrimagnetism–Ferromagnetism: origin and exchange interaction-saturation magnetization and Curie temperature –Domain Theory-M versus H behaviour –Hard and soft magnetic materials –examples and uses-–Magnetic principle in computer data storage
–Magnetic hard disc (GMR sensor).

**UNIT IV OPTICAL PROPERTIES OF MATERIALS 9**

Classification of optical materials –carrier generation and recombination processes -Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) -photo current in a P-N diode –solar cell-LED –Organic LED –Laser diodes –Optical data storage techniques.

**UNIT V NANO DEVICES 9**

Electron density in bulk material –Size dependence of Fermi energy –Quantum confinement – Quantum structures –Density of states in quantum well, quantum wire and quantum dot structure -Band gap of nanomaterials –Tunneling: single electron phenomena and single electron transistor –Quantum dot laser. Conductivity of metallic nanowires –Ballistic transport –Quantum resistance and conductance –Carbon nanotubes: Properties and applications.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Describe the origin of electrical and thermal conductivities in metal and semiconductors based on density of states and Fermi energy. | Understanding |

| | | |
|---|---|---|
| CO2 | Identify the nature of semiconductors based on carrier concentration and Fermi level for the design of semiconductor devices. | Understanding |
| CO3 | Differentiate different type of magnetic materials and their application in magnetic storage devices. | Understanding |
| CO4 | Obtain necessary understanding of the function of optical materials for photovoltaic, LED, laser diodes and optical storage. | Understanding |
| CO5 | Understand nano structures, quantum confinement and applications in nano devices. | Understanding |

**TEXT BOOKS:**


1. Jasprit Singh, ―Semiconductor Devices: Basic Principles‖, Wiley 2012.
2. Kasap, S.O. ―Principles of Electronic Materials and Devices‖, McGraw-Hill Education, 2007.
3. Kittel, C. ―Introduction to Solid State Physics‖. Wiley, 2005.


**REFERENCES:**


1. Gracia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
3. Rogers, B., Adams, J. &Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 2 | - | - |
| **CO2** | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 2 | - | - |
| **CO3** | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 2 | - | - |
| **CO4** | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 2 | - | - |
| **CO5** | 2 | - | - | - | 2 | - | 2 | - | - | - | - | 2 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**BE8255 BASIC ELECTRICAL, ELECTRONICS AND MEASUREMENT ENGINEERING L T P C 3 0 0 3**

**Course Objectives**

- To impart knowledge on basic electrical circuit components, laws and theorems.
- To explain the basic concepts of power system.
- To impart knowledge on working principle and characteristics of electrical machines.
- To introduce to different energy sources, protective devices and their field applications
- To describe the operation of various electronic devices, measuring instruments and transducers

**UNIT I ELECTRICAL CIRCUITS ANALYSIS 9**

Ohms Law, Kirchhoff's Law - Instantaneous Power- Series and Parallel Circuit Analysis with Resistive, Capacitive and Inductive network - Nodal Analysis, Mesh Analysis- Network Theorems – Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem and Superposition Theorem, Three-Phase Supply - Instantaneous, Reactive and Apparent Power-Star.DeltaConversion.

**UNIT II ELECTRICAL MACHINES 9**

DC and AC Rotating Machines: Types, Construction, Principle, emf and Torque Equation, Application Speed Control- Basics of Stepper Motor - Brushless DC Motors Transformers Introduction - Types and Construction, Working Principle of Ideal Transformer - emf Equation- All Day Efficiency Calculation.

**UNIT III UTILIZATION OF ELECTRICAL POWER 9**

Renewable Energy Sources - Wind and Solar Panels. Illumination by Lamps - Sodium Vapour, Mercury Vapour, Fluorescent Tube. Domestic Refrigerator and Air Conditioner - Electric Circuit, Construction and Working Principle. Batteries - NiCd, Pb Acid and Li ion – Charge and Discharge Characteristics. Protection - Need for Earthing, Fuses and Circuit Breakers. Energy Tariff Calculation for Domestic Loads.

**UNIT IV ELECTRONIC CIRCUITS 9**

PN Junction-VI Characteristics of Diode, Zener Diode, Transistors Configurations - Amplifiers. opamp- Amplifiers, Oscillator, Rectifiers, Differentiator, Integrator, ADC, DAC - Multi Vibrator using 555 Timer IC- Voltage Regulator IC using LM 723,LM 317.

**UNIT V ELECTRICAL MEASUREMENT 9**

Characteristic of Measurement - Errors in Measurement, Torque in Indicating Instruments - Moving Coil and Moving Iron Meters, Energy Meter and Watt Meter. Transducers - Classification – Thermo-electric, RTD, Strain Gauge, LVDT, LDR and Piezoelectric. Oscilloscope - CRO.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Explain** the basic concepts of power systems | Understanding |
| CO2 | **Describe** the construction, working principle and characteristics of various electrical machines | Understanding |
| CO3 | **Explain** the operation and characteristic features of various electronic devices | Understanding |
| CO4 | **Explain** the operation of different transducers, measuring instruments and their applications. | Understanding |

| | | |
|---|---|---|
| CO5 | **Apply** the basic concepts of circuit theory to solve single-phase and three-phase electric circuits | Applying |

**TEXT BOOKS:**


1. D.P. Kotharti and I.J Nagarath, Basic Electrical and Electronics Engineering, Mc Graw Hill, 2016, Third Edition.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.


**REFERENCES:**


1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016
2. B.L Theraja, Fundamentals of Electrical Engineering and Electronics. Chand & Co, 2008.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015
4. John Bird, ―Electrical and Electronic Principles and Technology‖, Fourth Edition, Elsevier, 2010.
5. Mittle,Mittal, Basic Electrical Engineering‖, 2nd Edition, Tata McGraw-Hill Edition, 2016.
6. C.L.Wadhwa, ―Generation, Distribution and Utilisation of Electrical Energy‖, New Age international pvt.ltd.,2003.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 |
| **CO2** | 3 | 2 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 |
| **CO3** | 3 | 1 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 |
| **CO4** | 2 | 1 | - | - | - | - | - | - | 1 | - | - | 3 | 2 | 1 |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 1 | - | - | 2 | 2 | 1 |

**GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C 3 0 0 3**

**Course Objectives**

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth‟s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers –energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 8**

Definition – causes, 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 – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air(Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act –Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On successful completion of this course students will be able to :

| | | |
|---|---|---|
| CO1 | Explain the concept, structure and function of different ecosystems and the significance of biodiversity | Understanding |
| CO2 | Illustrate the causes, effects and control measures for air, water, soil, marine and noise pollutions | Understanding |
| CO3 | Demonstrate the need of renewable energy resources and role of individual in conservation of natural resources | Understanding |
| CO4 | Describe the various rain water harvesting methods and environmental protection acts to the society | Understanding |
| CO5 | Estimate the population growth patterns around the globe and list the importance of role of IT in environment and human health | Understanding |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | - | - | 1 | 2 | - | - | - | - | - | - | - |
| **CO2** | 2 | 2 | - | - | - | 2 | 2 | - | - | - | - | - | - | - |
| **CO3** | 2 | 2 | 1 | - | - | 2 | 3 | - | - | - | - | - | - | - |
| **CO4** | 2 | 1 | - | - | - | 3 | 3 | - | - | - | - | - | - | - |
| **CO5** | 2 | 2 | - | - | - | 2 | 2 | - | - | - | - | - | - | - |

**CS8251 PROGRAMMING IN C L T P C 3 0 0 3**

**Course Objectives**

- To introduce basic programming constructs of C language
- To demonstrate the concepts of arrays, strings, functions and pointers of C language
- To impart knowledge in various types of C structures and their applications in dynamic memory allocation and file processing.

**UNIT I BASICS OF C PROGRAMMING 9**

Introduction to programming paradigms - Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process.

**UNIT II ARRAYS AND STRINGS 9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program**:** Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

**UNIT III FUNCTIONS AND POINTERS 9**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

**UNIT IV STRUCTURES 9**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Self referential structures – Dynamic memory allocation - Singly linked list – typedef.

**UNIT V FILE PROCESSING 9**

Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the various constructs of C language | Understanding |
| CO2 | Demonstrate the use of structures in dynamic memory allocation techniques. | Understanding |
| CO3 | Write a C program for the given algorithm using various constructs. | Applying |
| CO4 | Implement functions and pointers for various C applications | Applying |
| CO5 | Test , Debug and Optimize a C program | Analysing |
| CO6 | Solve real time problems using suitable data structures | Applying |

**TEXT BOOKS:**


1. Reema Thareja, ―Programming in C‖, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, ―The C Programming language, Second Edition, Pearson Education, 2006


**REFERENCES:**


1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | 2 | 3 | 2 |
| CO2 | 2 | 3 | 2 | 1 | - | - | - | - | 1 | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 1 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 1 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 1 | 3 | 3 | 2 |
| CO 6 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 1 | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**GE8162 ENGINEERING PRACTICES LABORATORY L T P C 0 0 4 2**

**Course Objectives:**

- To impart knowledge about basic electronic components
- To enable students to carry out basic home electrical wiring

**List of Experiments:**

**GROUP A (CIVIL & MECHANICAL) I CIVIL ENGINEERING PRACTICE 13 BUILDINGS:**
Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**PLUMBING WORKS:**
Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

(a) Study of pipe connections requirements for pumps and turbines.
(b) Preparation of plumbing line sketches for water supply and sewage works.
(c) Hands-on-exercise
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(d) Demonstration of plumbing requirements of high-rise buildings.
(e)

**CARPENTRY USING POWER TOOLS ONLY**
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

**II MECHANICAL ENGINEERING PRACTICE 18 WELDING:**

(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

**BASIC MACHINING:**
(a) Simple Turning and Taper turning
(b) Drilling Practice

**SHEET METAL WORK:**
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

**MACHINE ASSEMBLY PRACTICE:**
(a) Study of centrifugal pump
(b) Study of air conditioner

**DEMONSTRATION ON:**
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.

**GROUP B (ELECTRICAL & ELECTRONICS) III ELECTRICAL ENGINEERING PRACTICE 13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.

3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

**IV ELECTRONICS ENGINEERING PRACTICE 16**

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

| | | |
|---|---|---|
| CO1 | Select and connect appropriate tools & fittings for different pipeline connections and carpentry works. | Applying |
| CO2 | Perform the various welding, forming, bending, drilling and machining processes and know about its applications. | Applying |
| CO3 | Identify the value of resistors and the type of logic gates | Understanding |
| CO4 | Generate time delays using 555 timer IC and convert ac to dc signals using rectifiers | Applying |
| CO5 | Measure various electrical and electronic quantities using appropriate meters | Applying |
| CO6 | Implement basic house wiring plan | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | -- | -- | -- | -- | -- | -- | 2 | 1 | -- | -- | - | - |
| **CO2** | 2 | 2 | -- | -- | -- | -- | -- | -- | 2 | 1 | -- | -- | - | - |
| **CO3** | 2 | 1 | -- | 1 | -- | -- | -- | 3 | 2 | -- | -- | 2 | 3 | - |
| **CO4** | 3 | 2 | -- | 1 | -- | -- | -- | 3 | 2 | -- | -- | 2 | 3 | 2 |
| **CO5** | 3 | 2 | -- | 1 | -- | -- | -- | 3 | 2 | -- | -- | 2 | - | - |
| **CO6** | 3 | 2 | -- | 1 | -- | -- | -- | 3 | 2 | -- | -- | 2 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8261 C PROGRAMMING LABORATORY L T P C 0 0 4 2**

**Course Objectives**

- To develop programs in C using basic constructs.
- To develop applications in C using strings, pointers, functions, structures.
- To develop applications in C using file processing.

**LIST OF EXPERIMENTS:**

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
    - 5 if it is a perfect cube.
    - 4 if it is a multiple of 4 and divisible by 6.
    - 3 if it is a prime number.
7. Sort the numbers based on the weight in the increasing order as shown below <10, its weight>,<36,its weight><89,its weight>
8. Populate an array with height of persons and find how many persons are above the average height.
9. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
10. Given a string ―a$bcd./fg‖ find its reverse without changing the position of special characters.
11. (Example input:a@gh%;j and output:j@hg%;a)
12. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
13. From a given paragraph perform the following using built-in functions:
    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
14. Solve towers of Hanoi using recursion.
15. Generate salary slip of employees using structures and pointers
16. Compute internal marks of students for five different subjects using structures and functions.
17. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
18. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
19. Mini project
20. Create a ―Railway reservation system‖ with the following modules
    - Booking
    - Availability checking
    - Cancellation
    - Prepare chart

**TOTAL: 60 PERIODS**

**Course Outcomes:**
At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Write C programs using Input/output, decision control, looping , arrays, strings, recursion, functions, pointers, structures and files statements. | Applying |
| CO2 | Develop mini project using all constructs of C language | Applying |

**Correlation of Course Outcome (CO) with Program Outcomes (PO):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 1 | - | - | - | - | 1 | - | 1 | 2 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 3 | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**MA8351 DISCRETE MATHEMATICS L T P C 4 0 0 4**

**Course Objectives:**

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

**UNIT I LOGIC AND PROOFS 12**

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

**UNIT II COMBINATORICS 12**

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

**UNIT III GRAPHS 12**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

**UNIT IV ALGEBRAIC STRUCTURES 12**

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

**UNIT V LATTICES AND BOOLEAN ALGEBRA 12**

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Apply the conceptsof logic and rules of inference to solve the problems. | Understanding |
| CO2 | Solve the engineering problems using mathematical induction. | Understanding |
| CO3 | Solve the counting problems related to pigeonhole principle, generating functions and inclusion and exclusion principle. | Understanding |
| CO4 | Analyze the graph models and test isomorphism of graphs and connectedness. | Understanding |
| CO5 | Apply the concepts ofalgebraic systems in groups, rings and fields. | Understanding |
| CO6 | Apply the concepts of lattices and Boolean algebra based on homeomorphisms. | Understanding |

**TEXTBOOKS:**

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition,2011.
2. Tremblay, J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint,2011.

**REFERENCES:**

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition,2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications,2006.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO6 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8351 DIGITAL PRINCIPLES AND SYSTEM DESIGN L T P C 4 0 0 4**

**Course Objectives**

- Learn the various number systems.
- Learn Boolean Algebra
- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Be familiar with designing synchronous and asynchronous sequential circuits.
- Be exposed to designing using PLD

**UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 12**

Number Systems - Arithmetic Operations - Binary Codes- Boolean Algebra and Logic Gates - Theorems and Properties of Boolean Algebra - Boolean Functions - Canonical and Standard Forms - Simplification of Boolean Functions using Karnaugh Map - Logic Gates – NAND and NOR Implementations.

**UNIT II COMBINATIONAL LOGIC 12**

Combinational Circuits – Analysis and Design Procedures - Binary Adder-Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders – Encoders – Multiplexers - Introduction to HDL – HDL Models of Combinational circuits.

**UNIT III SYNCHRONOUS SEQUENTIAL LOGIC 12**

Sequential Circuits - Storage Elements: Latches , Flip-Flops - Analysis of Clocked Sequential Circuits - State Reduction and Assignment - Design Procedure - Registers and Counters - HDL Models of Sequential Circuits.

**UNIT IV ASYNCHRONOUS SEQUENTIAL LOGIC 12**

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

**UNIT V MEMORY AND PROGRAMMABLE LOGIC 12**

RAM – Memory Decoding – Error Detection and Correction - ROM - Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices.

**TOTAL: 45 PERIODS**

**Course outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Simplify Boolean functions and implement using logic gates. | Understanding |
| CO2 | Design and implement a system using combinational logic for the given specification; Simulate combinational logic systems using verilog or VHDL. | Applying |
| CO3 | Design and implement synchronous sequential system for the given specification; Simulate sequential logic systems using verilog or VHDL. | Applying |
| CO4 | Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards. | Analyzing |
| CO5 | Design and implement memory accessing systems and systems using PLA, PAL. | Analyzing |

**TEXT BOOK:**

1. M. Morris R. Mano, Michael D. Ciletti, ―Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson Education, 2017.

**REFERENCES:**


1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010
2. John F. Wakerly, Digital Design Principles and Practices, Fifth Edition, Pearson Education, 2017.
3. Charles H. Roth Jr, Larry L. Kinney, Fundamentals of Logic Design, Sixth Edition, CENGAGE Learning, 2013
4. Donald D. Givone, Digital Principles and Design‖, Tata Mc Graw Hill, 2003


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | - | - | - | 1 | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | 3 | - | 1 | - | 1 | - | - | - | - | - | 1 | 2 |
| **CO3** | 3 | 1 | 3 | - | 1 | - | 1 | - | - | 2 | - | - | 1 | 2 |
| **CO4** | 3 | 3 | 3 | - | 1 | - | 1 | - | - | 2 | 1 | 2 | 1 | 2 |
| **CO5** | 3 | 1 | 3 | - | 1 | - | 1 | - | - | 2 | 1 | 2 | 1 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8391 DATA STRUCTURES L T P C 3 0 0 3**

**Course Objectives:**

- To understand the concepts of ADTs
- To Learn linear data structures – lists, stacks, and queues
- To understand sorting, searching and hashing algorithms
- To apply Tree and Graph structures

**UNIT I LINEAR DATA STRUCTURES – LIST 9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

**UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9**

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

**UNIT III NON LINEAR DATA STRUCTURES – TREES 9**

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

**UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9**

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

**UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9**

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| **CO1** | Write applications using linear Abstract Data Types (ADTs) such as arrays and linked lists. | Understanding |
| **CO2** | Design and develop programs using stack and Queue ADTs. | Understanding |
| **CO3** | Select suitable tree ADTs such as the Threaded binary tree, B+ tree, AVL Tree and Heap tree and write programs to implement real – time applications. | Applying |
| **CO4** | Solve topological sorting and shortest path problems using graph ADT operations. | Applying |
| **CO5** | Critically analyze and write programs for sorting techniques such as bubble sort, selection sort, insertion sort, shell sort and radix sort. | Analyzing |

**TEXT BOOKS:**


1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011

**REFERENCES:**


1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
3. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| **CO/ PO/ PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 1 | 3 | 2 | 2 | - | - | - | 1 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 2 | 2 | 1 | - | - | - | - | 2 | 2 | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 2 | 2 | 2 | 1 | - | - | - | 3 | 1 | 3 | - | 3 |
| CO4 | 2 | 3 | 2 | 1 | - | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 | 2 | 3 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8392 OBJECT ORIENTED PROGRAMMING L T P C 3 0 0 3**

**Course Objectives:**

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of packages, inheritance and interfaces
- To define exceptions and use I/O streams
- To develop a java application with threads and generics classes
- To design and build simple Graphical User Interfaces

**UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10**

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members - Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.

**UNIT II INHERITANCE AND INTERFACES 9**

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, Array Lists - Strings

**UNIT III EXCEPTION HANDLING AND I/O 9**

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

**UNIT IV MULTITHREADING AND GENERIC PROGRAMMING 8**

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

**UNIT V EVENT DRIVEN PROGRAMMING 9**

Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events - AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the principles of Object Oriented Programming | Understanding |
| CO2 | Demonstrate the Java programs with the concepts of inheritance and interfaces | Understanding |
| CO3 | Build Java applications using exceptions and I/O streams | Applying |
| CO4 | Develop Java applications with threads and generics classes | Applying |
| CO5 | Develop interactive Java programs using swings | Applying |

**TEXT BOOKS:**


1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 9th Edition, Prentice Hall, 2013.


**REFERENCES:**


1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO / PO / PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 3 |
| CO2 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 3 |
| CO4 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 3 |
| CO5 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**EC8395 COMMUNICATION ENGINEERING L T P C 3 0 0 3**

**Course Objectives**

- To impart an understanding on analog and digital communication techniques.
- To introduce the use data and pulse communication techniques
- To impart the knowledge to analyze Source and Error control coding
- To introduce various spread spectrum and multiple access techniques

**UNIT I ANALOG MODULATION 9**

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

**UNIT II PULSE MODULATION 9**

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM And ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing

**UNIT III DIGITAL MODULATION AND TRANSMISSION 9**

Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

**UNIT IV INFORMATION THEORY AND CODING 9**

Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes, Syndrome calculation – Convolution Coding, Sequential and Viterbi decoding

**UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9**

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Describe** various modulation and demodulation techniques | Understanding |
| CO2 | **Evaluate** analog, digital and pulse modulation and demodulation techniques using various performance parameters | Applying |
| CO3 | **Explain** various pulse shaping techniques | Understanding |
| CO4 | **Design** different source and error control coding techniques | Applying |
| CO5 | **Describe** spread spectrum techniques and multiple access techniques | Understanding |

**TEXT BOOKS:**


1. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007
2. S. Haykin “Digital Communications” John Wiley 2005

**REFERENCES:**


1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd edition, Oxford University Press, 2007
2. H P Hsu, Schaum Outline Series – "Analog and Digital Communications" TMH 2006.
3. B.Sklar, Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | 2 | - | - | 1 | - | - |
| **CO3** | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **CO4** | 2 | 3 | - | - | - | - | - | - | 2 | - | - | 1 | 1 | - |
| **CO5** | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8381 DATA STRUCTURES LABORATORY L T P C 0 0 4 2**

**Course Objectives:**

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

**List of Experiments:**

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| **CO1** | Write functions to implement linear and non-linear data structure and operations. | Applying |
| **CO2** | Suggest and validate appropriate linear and non-linear data structure operations for solving a given problem. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 3 | 3 | 2 | - | - | - | - | 2 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8383 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C 0 0 4 2**

**Course Objectives:**

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, array list, exception handling and file processing.
- To develop applications using generic programming and event handling.

**LIST OF EXPERIMENTS**

1. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

   If the type of the EB connection is domestic, calculate the amount to be paid as follows:

   - First 100 units - Rs. 1 per unit
   - 101-200 units - Rs. 2.50 per unit
   - 201 -500 units - Rs. 4 per unit
   - > 501 units - Rs. 6 per unit

   If the type of the EB connection is commercial, calculate the amount to be paid as follows:

   - First 100 units - Rs. 2 per unit
   - 101-200 units - Rs. 4.50 per unit
   - 201 -500 units - Rs. 6 per unit
   - 501 units - Rs. 7 per unit

2. Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.
3. Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5. Write a program to perform string operations using Array List. Write functions for the following
   a. Append - add at end
   b. Insert – add at particular index
   c. Search
   d. List all string starts with given letter.
6. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7. Write a Java program to implement user defined exception handling.

8. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10. Write a java program to find the maximum value from the given type of elements using a generic function.
11. Design a calculator using event-driven programming paradigm of Java with the following options.
    - Decimal manipulations
    - Scientific manipulations
12. Develop a mini project for any application using Java concepts.

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Develop, implement and validate java programs for various practical applications. | Applying |
| CO2 | Develop an applications using event handling. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO 2 | PO3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | - | - | - | 2 | 3 | 2 | 1 | 1 | 1 | 3 |
| **CO2** | 3 | 3 | 3 | 1 | - | - | - | 2 | 3 | 2 | 2 | 1 | 1 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8382 DIGITAL SYSTEMS LABORATORY L T P C 0 0 4 2**

**Course Objectives**

- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Understand the various components used in the design of digital computers.
- Be exposed to sequential circuits
- Learn to use HDL

**List of Experiments**

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement Half/Full Adder and Subtractor.
4. Design and implement combinational circuits using MSI devices:
    - 4 – bit binary adder / subtractor
    - Parity generator / checker
    - Magnitude Comparator
    - Application using multiplexers
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Design and implement asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.
10. Design and implementation of a simple digital system (Mini Project).

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Implement Boolean Simplification Techniques to design combinational and Sequential Hardware Circuit. | Applying |
| CO2 | To design and analyze the simple digital systems using verilog or VHDL. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | - | - | - | 1 | - | - | - | 1 | 2 | 1 | 2 |
| CO2 | 3 | 2 | 3 | - | 1 | - | 1 | - | - | 2 | 1 | 2 | 1 | 2 |

**HS8381 INTERPERSONAL SKILLS/LISTENING & SPEAKING L T P C 0 0 2 1**

**Course Objectives:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

**UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures - conversational speech listening to and participating in conversations - persuade.

**UNIT V**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL:30PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Hone** active listening skills to connect better with people. | Apply |
| CO2 | **Refine** their pronunciation, use proper stress, and intonation to speak clearly. | Apply |
| CO3 | **Introspect** and strengthen their communication skills in formal and informal situations. | Apply |
| CO4 | **Augment** their presentation skills | Understand |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | 1 | - | - | - | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | - | 1 | 2 | - | 3 | - | - |
| CO3 | - | - | - | - | - | - | - | - | 2 | 2 | - | 3 | | |
| CO4 | - | - | - | 1 | - | - | - | - | 1 | 2 | - | 3 | | |

1: **L**ow 2: **M**edium 3: **H**igh

**MA8402 PROBABLITY AND QUEUING THEORY L T P C 4 0 0 4**

**Course Objectives:**

- To introduce the concepts of probability for solving problems in communication engineering.
- To outline the basics of one and two dimensional random variables to establish a relationship between dependent and independent variables.
- To acquaint the student about random processes for finding solutions to Markov chain.
- To understand the concepts of queuing models and their application in engineering.
- To show the importance of probabilistic models in science and engineering.

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**UNIT III RANDOM PROCESSES 12**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

**UNIT IV QUEUEING MODELS 12**

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms – Queues with impatient customers : Balking and reneging.

**UNIT V ADVANCED QUEUEING MODELS 12**

Finite source models - M/G/1 queue – PollaczekKhinchin formula - M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

**TOTAL : 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Solve the problems related to random variables and standard distributions. | Applying |
| CO2 | Solve the problems on two dimensional random variables. | Applying |
| CO3 | Apply the Concepts of random processes in engineering problems. | Applying |
| CO4 | Acquire skills in analyzing queuing models. | Applying |
| CO5 | Apply and characterize phenomenon which evolve with respect to time in a probabilistic manner. | Applying |

**TEXTBOOKS:**

1. Gross,D., Shortle,J.F, Thompson,J. MandHarris.C.M., "Fundamentals of Queuing Theory", Wiley Student 4th Edition,2014.
2. Ibe,O.C., "FundamentalsofAppliedProbabilityandRandomProcesses",Elsevier,1stIndian Reprint,2007.

**REFERENCES:**

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi,2004.
2. Taha, H.A., "Operations Research", 9th Edition, Pearson India Education Services, Delhi, 2016.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons,2002.
4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore,2012.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8491 COMPUTER ARCHITECTURE L T P C 3 0 0 3**

**Course Objectives**:

- To make students understand the basic structure, architecture and operations of a computer also communication among I/O devices.
- To impart the basics of pipelined execution.
- To deliver parallelism and multi-core processors.
- To inculcate memory hierarchies, cache memories and virtual memories.

**UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9**

Functional Units –Basic Operational Concepts –Performance –Instructions: Language of the Computer –Operations, Operands –Instruction representation –Logical operations –decision making –MIPS Addressing.

**UNIT II ARITHMETIC FOR COMPUTERS 9**

Addition and Subtraction –Multiplication –Division –Floating Point Representation –Floating Point Operations –Subword Parallelism

**UNIT III PROCESSOR AND CONTROL UNIT 9**

A Basic MIPS implementation –Building a Data path –Control Implementation Scheme – Pipelining –Pipelined datapath and control –Handling Data Hazards & Control Hazards – Exceptions.

**UNIT IV PARALLELISIM 9**

Parallel processing challenges –Flynn‘s classification –SISD, MIMD, SIMD, SPMD, and Vector Architectures -Hardware multithreading –Multi-core processors and other Shared Memory Multiprocessors-Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**UNIT V MEMORY & I/O SYSTEMS 9**

Memory Hierarchy -memory technologies –cache memory –measuring and improving cache performance –virtual memory, TLB‘s –Accessing I/O Devices –Interrupts –Direct Memory Access –Bus structure –Bus operation –Arbitration –Interface circuits - USB.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Evaluate the performance of the system and its components. | Analyzing |
| CO2 | Design an arithmetic logic unit which will implement arithmetic and logical operations. | Applying |
| CO3 | Draw the data and control path for a pipelined processor | Applying |
| CO4 | Compare the different parallel processing architectures. | Understanding |
| CO5 | Explain the memory hierarchies also the functionalities of I/O devices. | Understanding |

**TEXT BOOKS:**


1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

**REFERENCES:**


1. William Stallings, Computer Organization and Architecture –Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | - | - | 1 | - | - | - | - | 1 | 1 | 2 |
| CO2 | 3 | 2 | 3 | 1 | 2 | - | - | - | 1 | - | 2 | 3 | 2 | 2 |
| CO3 | 2 | 1 | 2 | 1 | 1 | - | 1 | - | - | - | - | 2 | 1 | 1 |
| CO4 | 2 | - | - | - | 2 | - | - | - | 1 | - | - | 2 | - | 2 |
| CO5 | 2 | 2 | 2 | - | 1 | - | - | - | - | - | - | 1 | - | 2 |

**1:** Low **2:** Medium **3:** High

**CS8492 DATABASE MANAGEMENT SYSTEM L T P C 3 0 0 3**

**Course Objectives**

- To make the students to collect the fundamentals of relational data model and representation of database system using ER diagrams
- To utilize the vital concepts of Structured Query Language (SQL) and relational database design applying normalization criteria
- To understand the essential theory of transactions, schedule and recovery process extend with concurrency control techniques such as lock based and time stamp-based protocols
- To familiarize the students with the internal storage structures using different file and indexing techniques
- To expose the students with the necessary information about the distributed database, object-based databases and XML databases

**UNIT I RELATIONAL DATABASES 10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

**UNIT II DATABASE DESIGN 8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**UNIT III TRANSACTIONS 9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

**UNIT IV IMPLEMENTATION TECHNIQUES 9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation.

**UNIT V ADVANCED TOPICS 9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems.

**TOTAL: 45 PERIODS**

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

| | | |
|---|---|---|
| CO1 | Draw ER diagrams from relational model using the fundamental concepts | Understanding |
| CO2 | Summarize the information retrieval process for the distributed database | Understanding |
| CO3 | Construct optimized SQL queries using normalization techniques | Applying |

| | | |
|---|---|---|
| CO4 | Map the real time situations used for the theory of transactions, schedule, recovery process and concurrency control techniques | Understanding |
| CO5 | Distinguish various indexing and hashing strategies in different database systems | Understanding |

**TEXT BOOKS:**


1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson Education, 2011.


**REFERENCES:**


1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems‖, Tata McGraw Hill, 2011.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | 1 | 1 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 |
| **CO2** | 1 | - | - | - | 1 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 |
| **CO3** | 2 | 1 | 2 | - | 2 | 2 | - | - | 2 | - | 2 | 2 | 2 | 1 |
| **CO4** | 2 | 2 | - | 1 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 2 | 3 | 2 |
| **CO5** | 2 | 2 | - | - | 1 | 1 | - | - | 1 | - | 1 | 1 | 2 | 1 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8451 DESIGN AND ANALYSIS OF ALGORITHMS L T P C 3 0 0 3**

**Course Objectives**

- To impart the core concepts of algorithm analysis.
- To demonstrate the efficiency of alternative algorithmic solutions for the same problem.
- To introduce different algorithm design techniques.
- To expose limitations of Algorithmic power using P, NP, NP Hard and NP Complete problems.

**UNIT I INTRODUCTION 9**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms - Visualization

**UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9**

Brute Force – Computing an – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

**UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9**

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim‘s algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

**UNIT IV ITERATIVE IMPROVEMENT 9**

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem.

**UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9**

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of the course students will be able to

| | | |
|---|---|---|
| CO1 | Demonstrate the mathematical analysis of various algorithms. | Applying |
| CO2 | Modify the existing algorithms to improve efficiency. | Applying |
| CO3 | Analyze the time and space complexity of algorithms. | Analyzing |
| CO4 | Analyze the different algorithm design techniques for a given problem. | Analyzing |
| CO5 | Design algorithms for various computing problems. | Creating |

**TEXT BOOK:**

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition,Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

**REFERENCES:**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, Data Structures and Algorithms, Pearson Education, Reprint 2006.
3. Harsh Bhasin, Algorithms Design and Analysis, Oxford university press, 2016.
4. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
5. http://nptel.ac.in/

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 3 | 3 |
| **CO2** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | 3 | 3 |
| **CO3** | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 3 | 3 |
| **CO4** | 3 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |

**CS8493 OPERATING SYSTEMS L T P C 3 0 0 3**

**Course Objectives**

- To enable the students to understand the basic concepts and functions of operating systems.
- To expose the students to understand the role of operating systems as a resource manager in managing processes, memory, files and I/O devices.

**UNIT I OPERATING SYSTEMS OVERVIEW 7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization-Operating System Structure and Operations-System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT 11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 - Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks.

**UNIT III STORAGE MANAGEMENT 9**

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV I/O SYSTEMS 9**

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation- File System Structure, Directory Structure, Allocation Methods, Free Space Management, I/O Systems.

**UNIT V CASE STUDY 9**

Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen, VMware on Linux Host and Adding Guest OS.

**TOTAL: 45 PERIODS**

**Course Outcomes**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the basic elements of a computer system and an operating system | Understanding |
| CO2 | Solve scheduling, synchronization and deadlock problems pertaining to processes and threads. | Applying |
| CO3 | Compare the memory management techniques for 32 and 64-bit architectures. | Understanding |
| CO4 | Discuss the functionalities of I/O systems and file systems. | Understanding |
| CO5 | Demonstrate the administrative tasks on Linux Servers and compare the features of Android and iOS. | Understanding |

**TEXT BOOK:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

**REFERENCES:**

1. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| **CO4** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 1 |
| **CO5** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | 1 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8494 SOFTWARE ENGINEERING L T P C 3 0 0 3**

**Course Objectives**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies

**UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

**UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements managementClassical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

**UNIT III SOFTWARE DESIGN 9**

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

**UNIT IV TESTING AND MAINTENANCE 9**

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing –Integration Testing – Validation Testing – System Testing And Debugging – SoftwareImplementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

**UNIT V PROJECT MANAGEMENT 9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning –Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

**UNIT V PROJECT MANAGEMENT 9**

Estimation – FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM - Scheduling and Tracking –Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Understand the basics of software process and project management. | Understanding |

| | | |
|---|---|---|
| CO2 | Identify the basic requirements of a software project. | Understanding |
| CO3 | Demonstrate the design process and data flow of a Software model. | Understanding |
| CO4 | Relate the various software techniques for testing and implementation. | Applying |
| CO5 | Analyze the factors and risks involved in project. | Analyzing |

**TEXT BOOK:**


1. Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.


**REFERENCES:**


1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning PrivateLimited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.
5. http://nptel.ac.in/.Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 2 | 3 |
| **CO2** | 1 | 3 | - | 2 | - | 1 | 1 | 1 | - | 2 | - | - | - | 2 |
| **CO3** | 2 | - | 3 | 1 | - | - | - | - | 1 | - | - | - | 2 | 2 |
| **CO4** | 1 | 2 | 1 | - | - | - | 1 | 1 | 2 | - | - | - | 1 | 2 |
| **CO5** | 1 | 1 | - | 1 | - | - | - | - | - | - | 3 | - | - | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8481 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C 0 0 4 2**

**Course Objectives:**

- Utilize data definition (DDL) and data manipulation (DML) queries for inserting, deleting, updating and retrieving Tables.
- Write functions and procedures of databases.
- Familiarize to work with the front-end tool.

**LIST OF EXPERIMENTS**

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
6. Procedures and Functions
7. Triggers
8. Exception Handling
9. Database Design using ER modelling, normalization and Implementation for any application
10. Database Connectivity with Front End Tools
11. Case Study using real life database applications

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO-1 | Build an application using DDL and DML queries and Write functions and procedures for database applications | Understanding |
| CO-2 | Design and develop the real time database application using ER modeling and normalization concepts. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO-1 | 2 | 2 | 2 | 1 | 3 | 3 | - | 1 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO-2 | 2 | 2 | 2 | 1 | 3 | 3 | - | 1 | 3 | 3 | 2 | 3 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8461 OPERATING SYSTEMS LABORATORY L T P C 0 0 4 2**

**Course Objectives**

- To expose the students to write UNIX commands and shell scripts in Linux.
- To enable the students to implement operating system algorithms pertaining to management of processes, memory, files and disks.

**List of experiments**

1. Basics of UNIX commands
2. Write programs using the system calls of UNIX (fork, exec, getpid, exit, wait, close, stat, opendir, readdir)
3. Simulation of UNIX commands in C (cp, ls, grep)
4. Shell programming
5. Implementation of CPU Scheduling algorithms in C
6. Implementation of Semaphores
7. Implementation of Shared memory and IPC
8. Bankers algorithm for Deadlock avoidance
9. Implementation of Deadlock Detection algorithm
10. Implementation of Threading and Synchronisation applications in C
11. Implementation of the following Memory allocation methods for fixed partition.
    a) First fit b) Worst fit c) Best fit
12. Implementation of Paging technique of Memory management
13. Implementation of the following Page replacement algorithms
    a) FIFO b) LRU c) LFU
14. Implementation of File organization techniques
15. Implementation of the following File allocation strategies.
    a) Sequential b) Indexed c) Indexed

**TOTAL PERIODS: 60**

**Course outcomes**

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

| | | |
|---|---|---|
| CO1 | **Execute** and validate UNIX commands and shell scripts in Linux. | Applying |
| CO2 | **Develop**, implement and validate operating system algorithms pertaining to management of processes, Memory, files and disks. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 1 | - | 2 | 1 | 1 |
| CO2 | 3 | 3 | 2 | - | - | - | - | 2 | 2 | 2 | - | 2 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**HS8461 ADVANCED READING AND WRITING L T P C 0 0 2 1**

**Course Objectives**

- To exhibit basic strategies of reading and writing in fluent, appropriate grammar with emphasis on vocabulary;
- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing.
- To develop students' critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

**UNIT I**

Reading-Strategies for effective reading-Use glosses and footnotes to aid reading comprehension-Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing-Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

**UNIT II**

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing-Write a paragraph with reasons and examples-Write an opinion paragraph

**UNIT III**

Reading-Understanding pronoun reference and use of connectors in a passage-speed reading techniques-Writing-Elements of a good essay-Types of essays-descriptive-narrative-issue-based-argumentative-analytical.

**UNIT IV**

Reading-Genre and Organization of Ideas-Writing-Email writing-resumes –Job application-project writing-writing convincing proposals.

**UNIT V**

Reading-Critical reading and thinking-understanding how the text positions the reader-identify Writing-Statement of Purpose-letter of recommendation-Vision statement

**TOTAL: 30 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Comprehend** information after reading in print and online sources | Understanding |
| CO2 | **Summarize** in writing ideas from a given text | Applying |

**TEXT BOOKS:**


1. Gramer F. Margot and Colin S. WardReading and Writing (Level 3) Oxford University Press: Oxford, 20112.
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011


**REFERENCES:**


1. Davis, Jason and Rhonda LIss.Effective Academic Writing (Level 3) Oxford University Press: Oxford, 20062.

2. E. Suresh Kumar and etal.Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 20123.
3. Withrow, Jeans and etal. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 20044.
4. Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 20005.
5. Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 3 | - | - |
| **CO2** | - | - | - | - | - | - | - | 1 | 2 | 3 | - | 3 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**MA8551 ALGEBRA AND NUMBER THEORY L T P C 4 0 0 4**

**Course Objectives:**

- To introduce the concepts of groups, rings, fields which will be used to solve related problems.
- To introduce and apply the concepts of rings, finite fields and polynomials.
- To understand the basic concepts in number theory
- To examine the key questions in the Theory of Numbers.
- To give an integrated approach to number theory and abstract algebra.

**UNIT I GROUPS AND RINGS 12**

Groups : Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n – Ringhomomorphism.

**UNIT II FINITE FIELDS AND POLYNOMIALS 12**

Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

**UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 12**

Division algorithm – Base - b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

**UNIT IV DIOPHANTINE EQUATIONS AND CONGRUENCES 12**

Linear Diophantine equations – Congruence‘s – Linear Congruence‘s - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

**UNIT V CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 12**

Wilson‘s theorem – Fermat‘s little theorem – Euler‘s theorem – Euler‘s Phi functions – Tau and Sigma functions.

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Understand the basic concepts of group and rings, and use appropriate techniques and reasoning to derive properties of groups, rings. | Applying |
| CO2 | Understand the polynomial rings and factorization of polynomials over finite fields and establish that a given polynomial is irreducible over a given base field. | Applying |
| CO3 | Define and interpret the concepts of divisibility, base-b representations, greatest common divisor, least common multiple, prime, and prime-factorization. | Applying |
| CO4 | Solve linear Diophantine equations and congruences of various types, and use the theory of congruence in applications. | Applying |
| CO5 | Prove classical theorems and apply properties of multiplicative functions such as the Euler phi-function and quadratic residues. | Applying |

**TEXTBOOKS:**


1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
2. Koshy, T., “Elementary Number Theory with Applications”, Elsevier Publications, New Delhi, 2002.

**REFERENCES:**


1. Lidl, R. and Pitz, G, "Applied Abstract Algebra", Springer Verlag, New Delhi, 2nd Edition, 2006.
2. Niven, I., Zuckerman.H.S., and Montgomery, H.L., "An Introduction to Theory of Numbers", John Wiley and Sons , Singapore, 2004.
3. San Ling and Chaoping Xing, "Coding Theory – A first Course", Cambridge Publications, Cambridge, 2004.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |

**CS8591 COMPUTER NETWORKS L T P C 3 0 0 3**

**Course Objectives:**

- To understand the protocol layering and physical level communication.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport and Application layer.

**UNIT I INTRODUCTION AND PHYSICAL LAYER 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS 9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER 9**

Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.

**UNIT V APPLICATION LAYER 9**

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On Completion of the course, the students should be able to:

| | | |
|---|---|---|
| CO1 | Enumerate the layers of the OSI model and TCP/IP. | Understanding |
| CO2 | Identify the different types of network devices and their functions within a network | Understanding |
| CO3 | Understand the basics of how data flows from one node to another | Understanding |
| CO4 | Understand the working of various application layer protocols | Understanding |
| CO5 | Solve routing problems by applying suitable routing algorithms | Applying |
| CO6 | Design, calculate, and apply subnet masks and addresses to fulfill networking requirements. | Applying |

**TEXT BOOK:**

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

**REFERENCES:**

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.

3. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011.
5. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.

**TOTAL: 45 PERIODS**

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | 1 | 3 | - | - | | - | 1 | - | 2 |
| **CO2** | 3 | 2 | 1 | - | 1 | 1 | 3 | - | - | - | - | 2 | - | 2 |
| **CO3** | 3 | 3 | 1 | - | 1 | 1 | 3 | - | - | - | - | 3 | - | 2 |
| **CO4** | 3 | 3 | 1 | - | 1 | 3 | 3 | - | - | - | - | 3 | - | 3 |
| **CO5** | 3 | 3 | 2 | - | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 |
| **CO6** | 3 | 3 | 2 | - | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | - | 3 |
| | 3 | 2.7 | 1.3 | - | 1.8 | 2.0 | 3.0 | 1.0 | 1.0 | - | 1.0 | 2.5 | - | 2.5 |

1: **L**ow 2: **M**edium 3: **H**igh

**EC8691 MICROPROCESSORS AND MICROCONTROLLERS L T P C 3 0 0 3**

**Course Objectives**

- To enable the students to understand the architectures of 8086 Microprocessor, 8051 Microcontroller and write Assembly Language Programs in them.
- To expose the students the knowledge of interfacing the 8086 microprocessor and 8051 microcontroller with peripheral devices.

**UNIT I THE 8086 MICROPROCESSOR 9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

**UNIT II 8086 SYSTEM BUS STRUCTURE 9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING 9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER 9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER 9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

**TOTAL: 45 PERIODS**

**Course Outcomes**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | **Discuss** the internal architecture of 8086 Microprocessor and 8051 Microcontroller along with their instruction sets | Understanding |
| CO2 | **Summarize** the features of advanced processors and discuss the working of 8086 based systems. | Understanding |
| CO3 | **Write** Assembly language programs using the instruction set of 8086 Microprocessor and 8051 Microcontroller. | Applying |
| CO4 | **Design** 8086 Microprocessor based real time systems by interfacing with memory and I/O devices. | Applying |
| CO5 | **Develop** 8051 Microcontroller based real time systems by interfacing with memory and I/O devices. | Applying |

**TEXT BOOKS:**


1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson Education, 2011


**REFERENCE BOOKS:**


1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012
2. Nagoor kani, "Microprocessor and Microcontroller", McGraw Hill Education, 2016


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 1 | 1 |
| CO2 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 1 | 1 |
| CO3 | 3 | 2 | 1 | - | - | 1 | - | - | - | - | - | 2 | 2 | 1 |
| CO4 | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 2 | 2 | 3 |
| CO5 | 3 | 2 | 1 | - | - | 3 | - | - | - | - | - | 2 | 2 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8501 THEORY OF COMPUTATION L T P C 3 0 0 3**

**Course Objectives**

- To teach the language hierarchy
- To demonstrate construction of automata for any given pattern and to find its equivalent regular expressions
- To make the students design context free grammar for any given language
- To explain the significance of Turing machines and their capability
- To impart the knowledge on undecidable problems and NP class problems

**UNIT I AUTOMATA FUNDAMENTALS 9**

Introduction to formal proof – Additional forms of Proof – Inductive Proofs –Finite Automata – Deterministic Finite Automata – Non-deterministic Finite Automata – Finite Automata with Epsilon Transitions

**UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9**

Regular Expressions – FA and Regular Expressions – Proving Languages not to be regular – Closure Properties of Regular Languages – Equivalence and Minimization of Automata.

**UNIT III CONTEXT FREE GRAMMAR AND LANGUAGES 9**

CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata.

**UNIT IV PROPERTIES OF CONTEXT FREE LANGUAGES 9**

Normal Forms for CFG – Pumping Lemma for CFL – Closure Properties of CFL – Turing Machines – Programming Techniques for TM.

**UNIT V UNDECIDABILITY 9**

Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem, The Class P and NP.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Discuss the different kinds of proof and construct automata for any pattern. | Understanding |
| CO2 | Construct regular expression for any pattern and find minimization of automata. | Applying |
| CO3 | Write Context Free grammar for any construct. | Applying |
| CO4 | Design Turing machines for any language and propose computation solutions. | Applying |
| CO5 | Derive whether a problem is decidable or not. | Applying |

**TEXT BOOK:**

1. J.E.Hopcroft, R.Motwani and J.D Ullman, — "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003. S. Haykin, "Digital Communications", John Wiley, 2005

**REFERENCES:**

1. H.R.Lewis and C.H.Papadimitriou, — "Elements of the theory of Computation", Second Edition, PHI, 2003.

2. J.Martin, — "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2003.
3. Micheal Sipser, — "Introduction of the Theory and Computation", Thomson Brokecole, 1997.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | 1 | - | - | - | - | 1 | - | - | - | 3 | - |
| **CO2** | 3 | 2 | - | 1 | - | - | - | - | 1 | - | - | - | 3 | - |
| **CO3** | 3 | 3 | - | 1 | - | - | - | - | 1 | - | - | - | 3 | - |
| **CO4** | 3 | 3 | - | 1 | - | - | - | - | 1 | - | - | - | 3 | - |
| **CO5** | 3 | 2 | - | 1 | - | - | - | - | 1 | - | - | 2 | 3 | - |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8592 OBJECT ORIENTED ANALYSIS AND DESIGN L T P C 3 0 0 3**

**Course Objectives:**

- To demonstrate the basic concepts of OOAD.
- To explain the UML diagrams.
- To convert the design to code.
- To inculcate necessary skills to analyze and evaluate the modules.

**UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9**

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases

**UNIT II STATIC UML DIAGRAMS 9**

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams .

**UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9**

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling – When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams – Component and Deployment Diagrams – When to use Component and Deployment diagrams

**UNIT IV DESIGN PATTERNS 9**

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code.

**UNIT V TESTING 9**

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans

**TOTAL**: **45 Periods**

**Course Objectives:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Describe the Object Oriented concepts and its applications. | Remembering |
| CO2 | Demonstrate the uses of UML diagrams to develop a software product. | Understanding |
| CO3 | Apply UML diagrams to design a software for an application. | Applying |
| CO4 | Analyze the strengths and weakness of the design specification. | Analyzing |
| CO5 | Evaluate models with respect to their functionalities | Evaluating |
| O6 | Construct software design for a real life problem | Creating |

**TEXT BOOK:**


**1.** Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, Pearson Education, 2005.


**REFERENCES:**


1. Simon Bennett, Steve Mc Robb and Ray Farmer, "Object Oriented Systems Analysis and Design Using UML", Fourth Edition, Mc-Graw Hill Education, 2010.
2. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley, 1995.
3. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling language" , Third edition, Addison Wesley, 2003.
4. Paul C. Jorgensen, "Software Testing:- A Craftsman"s Approach", Third Edition, Auerbach Publications, Taylor and Francis Group, 2008.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | 1 | - | - | - | 2 | 3 | 2 |
| **CO2** | 3 | 3 | 2 | 3 | - | - | - | - | 2 | - | 3 | - | 3 | 2 |
| **CO3** | 3 | 3 | 1 | - | - | - | - | - | 2 | - | - | 2 | 3 | 2 |
| **CO4** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | 3 | 2 |
| **CO5** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 2 |
| **CO6** | 3 | 3 | 3 | - | - | - | - | - | 3 | - | 3 | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**EC8681 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY** **L T P C 0 0 4 2**

**Course Objectives**

- To expose the students to write Assembly language programs in 8086 Microprocessor and 8051 Microcontroller.
- To impart the skill in students to build real time systems by interfacing 8086 with I/O devices.

**List of experiments**

**8086 Programs using kits and MASM:**

1 Basic arithmetic and Logical operations
2 Move a data block without overlap
3 Code conversion, decimal arithmetic and Matrix operations
4 Floating point operations, string manipulations, sorting and searching
5 Password checking, Print RAM size and system date
6 Counters and Time Delay

**Peripherals and Interfacing Experiments:**

7 Traffic light control
8 Stepper motor control
9 Digital clock
10 Key board and Display
11 Printer status
12 Serial interface and Parallel interface
13 A/D and D/A interface and Waveform Generation

**8051 Experiments using kits and MASM:**

14 Basic arithmetic and Logical operations
15 Square and Cube program, Find 2's complement of a number
16 Unpacked BCD to ASCII

**TOTAL: 60 PERIODS**

**Course outcomes**

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

| | | |
|---|---|---|
| CO1 | Write and validate Assembly language programs using the instruction set of 8086 Microprocessor and 8051 Microcontroller. | Applying |
| CO2 | Design, implement and validate 8086 based real time systems by interfacing with I/O devices | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | | | 1 | | 1 | 1 | 1 | | 2 | 2 | 1 |
| CO2 | 3 | 2 | 3 | | | 3 | | 2 | 2 | 2 | | 2 | 2 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8582 OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY** **L T P C 0 0 4 2**

**Course Objectives:**

- Demonstrate the method of drawing UML diagrams using appropriate tools.
- Familiarize the various testing techniques.

**LIST OF EXPERIMNENTS:**

Draw standard UML diagrams using an UML modeling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system.
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using
   UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

**SUGGESTED DOMAINS FOR MINI-PROJECT:**

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

**TOTAL: 60 PERIODS**

**Course Outcomes:**
At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Design the UML diagrams for the problem statements. | Applying |
| CO2 | Develop a dynamic application that includes test cases. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | 3 | 1 | - | 1 | 3 | 2 | 1 | 2 | 2 | 3 |
| CO2 | 1 | 3 | 1 | 1 | 3 | 1 | - | 1 | 3 | 2 | 1 | 2 | 2 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8581 NETWORKS LABORATORY L T P C 0 0 4 2**

**Course Objectives:**

- To learn and use network commands.
- To learn socket programming.
- To use simulation tools to analyze the performance of various network protocols.

**LIST OF EXPERIMENTS**

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
   a) Echo client and echo server
   b) Chat
   c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of error correction code (like CRC).

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

On Completion of the course, the students should be able to:

| | | |
|---|---|---|
| CO1 | Implement networking commands and various protocols using TCP and UDP. | Applying |
| CO2 | Use simulation tools to analyze the performance of various network protocols. | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | - | - | 1 | 3 | - | - | | - | 1 | - | 2 |
| CO2 | 3 | 3 | 3 | - | 3 | 1 | 3 | - | - | - | - | 2 | - | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8651 INTERNET PROGRAMMING L T P C 3 0 0 3**

**Course Objectives**

- To understand the basic concepts of java in client server programming
- To learn the presentation layer technologies HTML and CSS
- To learn PHP and XML
- To use AJAX and web services

**UNIT I WEBSITEBASICS, HTML 5, CSS 3, WEB 2.0INTRODUCTION 9**

Web Essentials: Clients, Servers and Communication –The Internet –Basic Internet protocols –World wideweb –HTTP Request Message –HTTP Response Message –Web Clients –Web Servers –HTML5 –Tables –Lists –Image –HTML5 control elements –Semantic elements –Drag and Drop –Audio –Video controls -CSS3 –Inline, embedded and external style sheets –Rule cascading –Inheritance –Backgrounds –Border Images –Colors –Shadows –Text –Transformations –Transitions –Animations.

**UNIT II CLIENT SIDE PROGRAMMING 9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions-Exception Handling-Validation-Built-in objects-Event Handling-DHTML with JavaScript-JSON introduction –Syntax –Function Files –Http Request – SQL.

**UNIT III SERVER SIDE PROGRAMMING 9**

Servlets: Java Servlet Architecture-Servlet Life Cycle-Form GET and POST actions-Session Handling-Understanding Cookies-Installing and Configuring Apache Tomcat Web Server-DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example -JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

**UNIT IV PHP AND XML 9**

An introduction to PHP: PHP-Using PHP-Variables-Programcontrol-Built-in functions-Form Validation-Regular Expressions -File handling –Cookies -Connecting to Database. XML: Basic XML-Document Type Definition-XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

**UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9**

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction-Java web services Basics –Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At **the en**d of the course students will be able to

| | | |
|---|---|---|
| CO1 | Construct a basic website using HTML and Cascading Style Sheets | Applying |
| CO2 | Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms. | Applying |
| CO3 | Develop server side programs using Servlets and JSP. | Applying |
| C04 | Construct simple web pages in PHP and to represent data in XML format. | Applying |
| CO5 | Use AJAX and web services to develop interactive web applications. | Applying |

**TEXT BOOK:**


1. Deitel and Deitel and Nieto, ―Internet and World Wide Web -How to Program, Prentice Hall, 5th Edition, 2011.


**REFERENCES:**


1. Stephen Wynkoop and John Burke ―Running a Perfect Website, QUE, 2nd Edition,1999.
2. Chris Bates, Web Programming –Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective‖ , Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., ―Web Technology, Prentice Hall of India, 2011.5.UttamK.Roy, ―Web Technologies, Oxford University Press, 2011.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | 3 | -- | -- | 1 | 2 | 1 | -- | 1 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 1 | 3 | -- | -- | 1 | 2 | 1 | -- | 2 | 1 | 2 |
| CO3 | 3 | 3 | 2 | 1 | 3 | -- | -- | 1 | 2 | 1 | -- | 1 | 2 | 3 |
| CO4 | 3 | 3 | 2 | 1 | 3 | -- | -- | 1 | 2 | 1 | -- | 2 | 2 | 3 |
| C05 | 3 | 3 | 2 | 1 | 3 | -- | -- | 1 | 2 | 1 | -- | 2 | 2 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8691 ARTIFICIAL INTELLIGENCE L T P C 3 0 0 3**

**Course Objectives**

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI.

**UNIT I INTRODUCTION 9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

**UNIT II PROBLEM SOLVING METHODS 9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

**UNIT III KNOWLEDGE REPRESENTATION 9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information

**UNIT IV SOFTWARE AGENTS 9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

**UNIT V APPLICATIONS 9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving

**TOTAL :45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Use appropriate search algorithms for any AI problem | Understanding |
| CO2 | Represent a problem using first order and predicate logic | Applying |
| CO3 | Provide the apt agent strategy to solve a given problem | Applying |
| CO4 | Design software agents to solve a problem | Applying |
| CO5 | Design applications for NLP that use Artificial Intelligence. | Applying |

**TEXT BOOKS:**


1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. I. Bratko, ―Prolog: Programming for Artificial Intelligence‖, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

**REFERENCES:**


1. M. Tim Jones, ―Artificial Intelligence: A Systems Approach(Computer Science)‖, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, ―The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,‖ Programming in Prolog: Using the ISO Standard‖, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, ―Artificial Intelligence: Foundations of Computational Agents‖, Cambridge University Press, 2010.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | 2 | - | - | 2 | 2 | 2 |
| **CO2** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | 2 | - | - | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | 2 | - | - | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | 2 | - | - | 2 | 2 | 2 |
| **CO5** | 2 | 2 | 2 | 1 | 1 | 2 | - | - | 2 | - | - | 2 | 2 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8601 MOBILE COMPUTING L T P C 3 0 0 3**

**Course Objectives**

- To introduce the basic concepts of mobile computing.
- To describe the basics of mobile telecommunication system.
- To expose the major aspects of network layer protocol and Ad-Hoc network
- To describe the transport and application layer protocols.
- To demonstrate the different mobile and application development platforms
-

**UNIT I INTRODUCTION 9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA

**UNIT II MOBILE TELECOMMUNICATION SYSTEM 9**

Introduction to Cellular Systems - GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS-UMTS – Architecture – Handover - Security

**UNIT III MOBILE NETWORK LATYER 9**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks ( VANET) –MANET Vs VANET – Security.

**UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER 9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

**UNIT V MOBILE PLATFORMS AND APPLICATIONS 9**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

**TOTAL :45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Explain the MAC Protocols and generation of Mobile communication technologies | Understanding |
| CO2 | Demonstrate the various cellular system architecture. | Understanding |
| CO3 | Choose the appropriate routing protocols based on the network layer. | Applying |
| CO4 | Explain the Mobile Transport and Application layer architecture. | Understanding |
| CO5 | Develop a mobile application in different mobile platforms | Applying |

**TEXT BOOKS:**


1. Jochen Schiller, -Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, -Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012

**REFERENCES:**


1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems",Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, -Principles of Mobile Computing‖, Springer, 2003.
3. William.C.Y.Lee,-Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, -AdHoc Mobile Wireless Networks‖, First Edition, Pearson Education, 2002.
5. Android Developers : http://developer.android.com/index.html
6. Apple Developer : https://developer.apple.com/
7. Windows Phone DevCenter : http://developer.windowsphone.com
8. BlackBerry Developer : http://developer.blackberry.com


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 1 | 2 | 1 | 3 | - | - | 2 | 2 | - | 2 | - | - | 1 | 1 |
| **CO4** | 1 | - | 1 | 1 | - | - | 3 | 2 | - | 2 | - | - | 1 | 1 |
| **CO5** | 2 | 2 | 3 | 2 | 3 | - | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8602 COMPILER DESIGN L T P C 3 4 0 2**

**Course Objectives**

- To impart knowledge on the design principles of a Compiler.
- To teach the various parsing techniques and different levels of translation
- To make the students optimize and effectively generate machine codes

**UNIT I INTRODUCTION TO COMPILERS 9**

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

**UNIT II SYNTAX ANALYSIS 12**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

**UNIT III INTERMEDIATE CODE GENERATION 8**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

**UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

**UNIT V CODE OPTIMIZATION 8**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

**LIST OF EXPERIMENTS:**

1. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.). Create a symbol table, while recognizing identifiers.
2. Implement a Lexical Analyzer using Lex Tool
3. Implement an Arithmetic Calculator using LEX and YACC
4. Generate three address code for a simple program using LEX and YACC.
5. Implement simple code optimization techniques (Constant folding, Strength reduction and Algebraic transformation)
6. Implement back-end of the compiler for which the three address code is given as input and the 8086 assembly language code is produced as output.

**PRACTICALS : 30**
**THEORY : 45**
**TOTAL : 75**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Demonstrate the different phases of compiler using various programming language. | Understanding |
| CO2 | Construct a lexical analyzer using Deterministic Finite Automata and Non Deterministic Finite Automata. | Applying |
| CO3 | Implement the parser for a given Context Free Grammar using various parsing methods. | Analyzing |

| | | |
|---|---|---|
| CO4 | Implement the Intermediate code generation techniques and runtime environment. | Analyzing |
| CO5 | Analyze the code generation and optimization techniques. | Analyzing |

**TEXT BOOK:**


1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.


**REFERENCES:**


1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.
5. Allen I. Holub, Compiler Design in C‖, Prentice-Hall Software Series, 1993


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | 1 | 1 | -- | -- | -- | 1 | 1 | 1 | -- | 2 | 2 |
| **CO2** | 3 | 3 | 1 | 3 | 3 | -- | -- | -- | 3 | 3 | 3 | -- | 3 | 3 |
| **CO3** | 3 | 3 | 1 | 3 | 3 | -- | -- | -- | 3 | 3 | 3 | -- | 3 | 3 |
| **CO4** | 1 | 2 | 1 | 3 | 1 | -- | -- | -- | -- | -- | -- | -- | 3 | 1 |
| **CO5** | 1 | 2 | 1 | 1 | 2 | -- | -- | -- | -- | -- | -- | -- | 2 | 1 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8603 DISTRIBUTED SYSTEMS L T P C 3 0 0 3**

**COURSE OBJECTIVES**

- To understand the foundations of distributed systems and their communication models.
- To demonstrate the distributed mutual exclusion, deadlock detection algorithms and recovery protocols in Distributed Systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

**UNIT I INTRODUCTION 9**

Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications. Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.

**UNIT II MESSAGE ORDERING & SNAPSHOTS 9**

Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) - Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions – Snapshot algorithms for FIFO channels

**UNIT III DISTRIBUTED MUTEX & DEADLOCK 9**

Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport‘s algorithm – Ricart-Agrawala algorithm – Maekawa‘s algorithm – Suzuki–Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp‘s classification – Algorithms for the single resource model, the AND model and the OR model.

**UNIT IV RECOVERY & CONSENSUS 9**

Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure – free system – Agreement in synchronous systems with failures.

**UNIT V P2P & DISTRIBUTED SHARED MEMORY 9**

Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Describe the fundamentals of distributed systems. | Understanding |
| CO2 | Illustrate group communication models and global state for distributed systems. | Understanding |
| CO3 | Demonstrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems. | Applying |
| CO4 | Compare the checkpoint and rollback based recovery algorithms in distributed systems. | Analyzing |

| | | |
|---|---|---|
| CO5 | Explain the features of peer-to-peer and distributed shared memory systems | Understanding |

**TEXT BOOKS:**


1. Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, ―Distributed Systems Concepts and Design‖, Fifth Edition, Pearson Education, 2012.


**REFERENCES:**


1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., ―Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.
4. Liu M.L., ―Distributed Computing, Principles and Applications‖, Pearson Education, 2004.
5. Nancy A Lynch, ―Distributed Algorithms‖, Morgan Kaufman Publishers, USA, 2003.


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO / PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| **CO3** | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO5** | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8661 INTERNET PROGRAMMING LABORATORY L T P C 0 0 4 2**

**Course Objectives**

- To expose internet programming technologies relevant to web page designing.
- To demonstrate the dynamic web page using server side scripting.
- To illustrate the experimentation of client server applications.
- To demonstrate the usage of JavaScript, Ajax, Java Server Pages, PHP and XML.

**LIST OF EXPERIMENTS**

1. Create a web page with the following using HTML
   - To embed a map in a web page
   - To fix the hot spots in that map
   - Show all the related information when the hot spots are clicked.
2. Create a web page with the following.
   - Cascading style sheets.
   - Embedded style sheets.
   - Inline style sheets. Use our college information for the web pages.
3. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4. Write programs in Java using Servlets:
   - To invoke servlets from HTML forms
   - To invoke servlets from Applets
5. Write programs in Java to create three-tier applications using servlets for conducting on-line examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server
6. Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart
7. Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.
8. Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.
   - PHP
   - Validate the form using PHP regular expression
   - PHP stores a form data into database.
9. Write a web service for finding what people think by asking 500 people‘s opinion for any consumer product.

**TOTAL: 60 PERIODS**

**Course Outcomes:**
At the end of the course students will be able to

| | | |
|---|---|---|
| CO1 | Construct web pages using HTML/XML, CSS and Java Script | Applying |
| CO2 | Develop web applications using Servlets, JSP, PHP and web services | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 2 | - | - | 1 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 | - | - | 1 | 3 | 3 | 2 | 2 | 2 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8662 MOBILE APPLICATIONS DEVELOPMENT L T P C 0 0 4 2**

**Course objectives**

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the capabilities and limitations of mobile devices.

**LIST OF EXPERIMENTS**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Build a native application using GUI components and Mobile application development framework | Applying |
| CO2 | Model new applications to hand held devices | Creating |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | - | 3 | - | - | - | 2 | - | - | 1 | 3 | 3 |
| CO2 | 2 | 3 | 3 | - | 3 | - | - | - | 2 | - | - | 1 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**HS8581 PROFESSIONAL COMMUNICATION L T P C 0 0 2 1**

**OBJECTIVES: The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

**UNIT I**
Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**
Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**
Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies-activities to improve GD skills

**UNIT IV**
Interview etiquette – dress code – body language – attending job interviews–telephone/skype interview -one to one interview &panel interview – FAQs related to job interviews

**UNIT V**
Recognizing differences between groups and teams- managing time-managing stress-networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTAL : 30 PERIODS**

**Recommended Software** 1. Globearena 2. Win English

**COURSE OUTCOMES**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Demonstrate effective use of teamwork skills to complete communication tasks | Applying |
| CO2 | Use rhetorical strategies to produce persuasive research reports and presentations | Applying |

**REFERENCES:**


1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Interact English Lab Manual for Undergraduate Students,. Orient BalckSwan: Hyderabad, 2016.
4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | - | - | - | 3 | 3 | 3 | - | 3 | - | - |
| CO2 | - | - | - | - | - | - | - | 3 | 3 | 3 | - | 3 | - | - |

1: **L**ow 2: **M**edium 3: **H**igh

**MG6851 PRINCIPLES OF MANAGEMENT L T P C 3 0 0 3**

**Course Objectives**

- To un derstand the evolution and functions of Management
- To learn the principles of management
- To illustrate the principles, concepts and importance of planning, organizing, directing and controlling
- To learn the importance of the principles of management in an organization
-

**UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

**UNIT II PLANNING 9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

**UNIT III ORGANISING 9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

**UNIT IV DIRECTING 9**

Foundations of individual and group behaviour – motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership –communication – process of communication – barrier in communication – effective communication – Communication and IT.

**UNIT V CONTROLLING 9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Describe the evolution and functions of management | Understanding |
| CO2 | Illustrate the planning process in the organization | Understanding |
| CO3 | Explain the organizing and recruitment process in the organization | Understanding |
| CO4 | Discuss the motivational and leadership theories for effective direction of organization | Understanding |
| CO5 | Summarize the budgetary and non-budgetary control techniques | Understanding |

**TEXTBOOKS:**


1. Stephen P. Robbins & Mary Coulter, ―Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert ―Management‖, Pearson Education, 6th Edition, 2004.

**REFERENCES:**


1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, ―Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, ― Management‖, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich ―Essentials of management‖ Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, ―Principles of Management‖, Tata McGraw Hill, 1999


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | - | - | - | 1 | 1 | 2 | - | - | - |
| **CO2** | - | - | - | - | - | - | - | - | 2 | 1 | 2 | - | 1 | 1 |
| **CO3** | - | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| **CO4** | - | - | - | - | - | 2 | - | - | 3 | - | - | - | - | - |
| **CO5** | - | - | - | - | 2 | - | - | - | - | - | - | - | 1 | 1 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8792 CRYPTOGRAPHY AND NETWORK SECURITY L T P C 3 0 0 3**

**Course Objectives**

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

**UNIT I INTRODUCTION 9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid‟s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

**UNIT III PUBLIC KEY CRYPTOGRAPHY 9**

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler‟s totient function, Fermat‟s and Euler‟s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Illustrate cryptographic number theory, symmetric and asymmetric cryptographic techniques | Understanding |
| CO2 | Classify block ciphers ,stream ciphers, authentication techniques, Firewalls and Email security | Understanding |
| CO3 | Apply cryptographic algorithms for given data and applications | Applying |
| CO4 | Implement security services in the applications | Applying |
| CO5 | Examine various security mechanisms | Analyzing |

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I, II, III, IV).
2. TEXT BOOK: 1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006. REFERENCES:

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007. 3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 3 | 2 |
| CO2 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | - | - | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8791 CLOUD COMPUTING L T P C 3 0 0 3**

**Course Objectives**

- To understand the concept of cloud computing.
- To learn the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

**UNIT I INTRODUCTION 9**

Introduction to Cloud Computing –Definition of Cloud –Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing –Cloud Characteristics –Elasticity in Cloud –On-demand Provisioning.

**UNIT II CLOUD ENABLING TECHNOLOGIES 10**

Service Oriented Architecture –REST and Systems of Systems –Web Services –Publish-Subscribe Model –Basics of Virtualization –Types of Virtualization –Implementation Levels of Virtualization –Virtualization Structures –Tools and Mechanisms –Virtualization of CPU –Memory –I/O Devices –Virtualization Support and Disaster Recovery.

**UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 8**

Layered Cloud Architecture Design –NIST Cloud Computing Reference Architecture –Public, Private and Hybrid Clouds -laaS –PaaS –SaaS –Architectural Design Challenges –Cloud Storage –Storage-as-a-Service –Advantages of Cloud Storage –Cloud Storage Providers –S3.

**UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 10**

Inter Cloud Resource Management –Resource Provisioning and Resource Provisioning Methods –Global Exchange of Cloud Resources –Security Overview –Cloud Security Challenges –Software-as-a-Service Security –Security Governance –Virtual Machine Security –IAM –Security Standards.

**UNIT V CLOUD TECHNOLOGIESAND ADVANCEMENTS 8**

Hadoop –MapReduce –Virtual Box -Google App Engine –Programming Environment for Google App Engine ––Open Stack –Federation in the Cloud –Four Levels of Federation –Federated Services and Applications –Future of Federation.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of the course students will be able to

| | | |
|---|---|---|
| CO1 | Articulate the main concepts, key technologies, strengths and limitations of cloud computing | Understanding |
| CO2 | Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models. | Applying |
| CO3 | Solve the core issues of cloud computing such as resource management and security | Applying |
| CO4 | Implement the solutions that help in the development of cloud. | Applying |
| CO5 | Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud. | Applying |

**TEXT BOOK:**


1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
2. Rittinghouse, JohnW., and James F. Ransome,—Cloud Computing: Implementation, Management and Security‖ , CRC Press, 2017.

**REFERENCES:**


1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing -A Practical Approach, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009


**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |
| **CO2** | 3 | 3 | 1 | - | 1 | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO3** | 3 | 3 | 2 | - | 1 | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO4** | 3 | 3 | 1 | - | 1 | - | - | - | - | - | 2 | - | 3 | 3 |
| **CO5** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8711 CLOUD COMPUTING LABORATORY L T P C 0 0 4 2**

**Course Objectives**

- To introduce the deployment of web applications in cloud
- To demonstrate the design and development process involved in creating a cloud based application
- To impart the use of parallel programming using Hadoop

**LIST OF EXPERIMENTS**

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello worldapp and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

**TOTAL: 60 PERIODS**

**Course Outcomes:**

At the end of the course students will be able to

| | | |
|---|---|---|
| CO1 | Experiment various virtualization tools such as Virtual Box, VMware workstation and deploy a web application in a PaaS environment | Applying |
| CO2 | Demonstrate a generic cloud environment and manipulate large data sets in a parallel environment | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | - | - | 2 | - | - | - | - | - | - | - | 3 | 1 |
| **CO2** | 1 | 3 | 1 | 3 | 2 | - | - | - | - | - | - | 1 | 3 | 3 |

**IT8761 SECURITY LABORATORY L T P C 0 0 4 2**

**Course Objectives**

OBJECTIVES:

- To learn different cipher techniques
- To implement the algorithms DES, RSA,MD5,SHA-1
- To use network security tools and vulnerability assessment tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i) Rail fence ii) row & Column Transformation
3. Apply DES algorithm for practical applications.
4. Apply AES algorithm for practical applications.
5. Implement RSA Algorithm using HTML and JavaScript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME – Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool Defeating Malware i) Building Trojans ii) Rootkit Hunter

**TOTAL: 60 PERIODS**

**Course Outcomes:**
At the end of this course students will be able to:

| | | |
|---|---|---|
| CO1 | Implement Classical Cipher Techniques, Block Ciphers and Public key Cryptographic algorithms | Applying |
| CO2 | Use different open source tools for network security and analysis | Applying |

**Correlation of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):**

| **CO/ PO/ PSO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | - | - | 3 | 3 | 2 |

1: **L**ow 2: **M**edium 3: **H**igh

**CS8811** **PROJECT WORK** **L T P C 0 0 20 10**

**Course Objective**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 180 PERIODS**

**Course Outcome**

| | | |
|---|---|---|
| CO1 | Identify the problem by applying acquired knowledge and categorize executable project modules after considering risks | Analyzing |
| CO2 | Choose efficient tools for designing project module and Combine all the modules through effective team work after efficient testing | Creating |

| CO/ PO/ PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |

1: **L**ow 2: **M**edium 3: **H**igh

# Professional Elective

**CS8075 DATA WAREHOUSING AND DATA MINING L T P C 3 0 0 3**

**Course Objectives:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

**UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

**UNIT II DATA MINING – INTRODUCTION 9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques– Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT III DATA MINING - FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

**UNIT V WEKA TOOL 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Design a Data warehouse system and perform business analysis with OLAP tools.
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis
- Apply appropriate classification and clustering techniques for data analysis

**TEXT BOOK:**

1. Jiawei Han and Micheline Kamber, ―Data Mining Concepts and Techniques‖, Third Edition, Elsevier, 2012.

**REFERENCES:**


1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. K.P. Soman, Shyam Diwakar and V. Ajay, ―Insight into Data Mining Theory and Practice‖, Eastern Economy Edition, Prentice Hall of India, 2006.
3. Ian H.Witten and Eibe Frank, ―Data Mining: Practical Machine Learning Tools and Techniques‖, Elsevier, Second Edition.


**IT8076 SOFTWARE TESTING L T P C 3 0 0 3**

**Course Objectives:**

- To learn the criteria for test cases.
- To learn the design of test cases.
- To understand test management and test automation techniques.
- To apply test metrics and measurements.

**UNIT I INTRODUCTION 9**

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model- Testing axioms – Basic definitions – Software Testing Principles – The Tester‘s Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design –Defect Examples- Developer/Tester Support of Developing a Defect Repository.

**UNIT II TEST CASE DESIGN STRATEGIES 9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria– static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs– Covering Code Logic – Paths – code complexity testing – Additional White box testing approaches- Evaluating Test Adequacy Criteria.

**UNIT III LEVELS OF TESTING 9**

The need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – Scenario testing – Defect bash elimination System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Testing OO systems – Usability and Accessibility testing – Configuration testing –Compatibility testing – Testing the documentation – Website testing.

**UNIT IV TEST MANAGEMENT 9**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group- .The Technical Training Program.

**UNIT V TEST AUTOMATION 9**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Design test cases suitable for a software development for different domains.
- Identify suitable tests to be carried out.
- Prepare test planning based on the document.
- Document test plans and test cases designed.
- Use automatic testing tools.
- Develop and validate a test plan.

**TEXT BOOKS:**

1. Srinivasan Desikan and Gopalaswamy Ramesh, ―Software Testing – Principles and Practices‖, Pearson Education, 2006.
2. Ron Patton, ―Software Testing‖, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com

**REFERENCES:**

1. Ilene Burnstein, ―Practical Software Testing‖, Springer International Edition, 2003.
2. Edward Kit,‖ Software Testing in the Real World – Improving the Process‖, Pearson Education, 1995.
3. Boris Beizer,‖ Software Testing Techniques‖ – 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur, ―Foundations of Software Testing _ Fundamental Algorithms and Techniques‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

**IT8072 EMBEDDED SYSTEMS L T P C 3 0 0 3**

**Course Objectives:**

- To learn the architecture and programming of ARM processor.
- To become familiar with the embedded computing platform design and analysis.
- To get thorough knowledge in interfacing concepts
- To design an embedded system and to develop programs

**UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

**UNIT II EMBEDDED COMPUTING PLATFORM DESIGN 9**

The CPU Bus-Memory devices and systems–Designing with computing platforms – consumer electronics architecture – platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

**UNIT III SENSOR INTERFACING WITH ARDUINO**

**9**Basics of hardware design and functions of basic passive components-sensors and

ctuators- Arduino code - library file for sensor interfacing-construction of basic applications

**UNIT IV EMBEDDED FIRMWARE 9**

Reset Circuit, Brown-out Protection Circuit-Oscillator Unit - Real Time Clock-Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

**UNIT V EMBEDDED C PROGRAMMING 9**

Introduction-Creating _hardware delays' using Timer 0 and Timer 1-Reading switches-Adding Structure to the code-Generating a minimum and maximum delay-Example: Creating a portable hardware delay- Timeout mechanisms-Creating loop timeouts-Testing loop timeouts- hardware timeouts-Testing a hardware timeout

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Describe the architecture and programming of ARM processor.
- Explain the concepts of embedded systems
- Understand the Concepts of peripherals and interfacing of sensors.
- Capable of using the system design techniques to develop firmware
- Illustrate the code for constructing a system

**TEXT BOOKS:**


1. 1.Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (unit I & II)
2. https://www.coursera.org/learn/interface-with-arduino#syllabus (Unit III)
3. .Michael J. Pont, ―Embedded C‖, 2 nd Edition, Pearson Education, 2008.(Unit IV & V)


**REFERENCES:**


1. Shibu K.V, ―Introduction to Embedded Systems‖, McGraw Hill.2014
2. Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing‖, Third Edition Cengage Learning, 2012
3. Raj Kamal, ―Embedded Systems-Architecture,programming and design‖, 3 edition,TMH.2015
4. Lyla, ―Embedded Systems‖, Pearson , 2013
5 . David E. Simon, ―An Embedded Software Primer‖, Pearson Education,2000.


**CS8072 AGILE METHODOLOGIES L T P C 3 0 0 3**

**Course Objectives:**

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand the benefits and pitfalls of working in an Agile team.

- To understand Agile development and testing.

**UNIT I AGILE METHODOLOGY 9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model- Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

**UNIT II AGILE PROCESSES 9**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

**UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9**

Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

**UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

**UNIT V AGILITY AND QUALITY ASSURANCE 9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Realize the importance of interacting with business stakeholders in determining the requirements for a software system
- Perform iterative software development processes: how to plan them, how to execute them.
- Point out the impact of social aspects on software development success.
- Develop techniques and tools for improving team collaboration and software quality.
- Perform Software process improvement as an ongoing task for development teams.
- Show how agile approaches can be scaled up to the enterprise level.

**TEXT BOOKS:**

1. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003.
2. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science‖, Springer, 2009.

**REFERENCES:**

1. Craig Larman, ―Agile and Iterative Development: A Manager_s Guide‖, Addison-Wesley, 2004.
2. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management‖, Butterworth-Heinemann, 2007.

**CS8077 GRAPH THEORY AND APPLICATIONS L T P C 3 0 0 3**

**Course Objectives:**

- To understand fundamentals of graph theory.
- To study proof techniques related to various concepts in graphs.
- To explore modern applications of graph theory.

**UNIT I** **9**

Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems.

**UNIT II** **9**

Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration- Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity- Separability -Related Theorems.

**UNIT III** **9**

Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

**UNIT IV** **9**

Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

**UNIT V** **9**

Graph Algorithms- Connectedness and Components- Spanning Tree- Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Understand the basic concepts of graphs, and different types of graphs
- Understand the properties, theorems and be able to prove theorems.
- Apply suitable graph model and algorithm for solving applications.

**TEXT BOOKS:**

1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.

**REFERENCES:**

1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B., ―Introduction to Graph Theory‖, Pearson Education, 2011.
3. John Clark, Derek Allan Holton, ―A First Look at Graph Theory‖, World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007.

**IT8071 DIGITAL SIGNAL PROCESSING L T P C 3 0 0 3**

**Course Objectives:**

- To understand the basics of discrete time signals, systems and their classifications.
- To analyze the discrete time signals in both time and frequency domain.
- To design lowpass digital IIR filters according to predefined specifications based on analog filter theory and analog-to-digital filter transformation.
- To design Linear phase digital FIR filters using fourier method, window technique
- To realize the concept and usage of DSP in various engineering fields.

**UNIT I DISCRETE TIME SIGNALS AND SYSTEMS 9**

Introduction to DSP – Basic elements of DSP– Sampling of Continuous time signals– Representation, Operation and Classification of Discrete Time Signal–Classification of Discrete Time Systems– Discrete Convolution: Linear and Circular–Correlation.

**UNIT II ANALYSIS OF LTI DISCRETE TIME SIGNALS AND SYSTEMS 9**

Analysis of LTI Discrete Time Systems using DFT–Properties of DFT–Inverse DFT– Analysis of LTI Discrete Time Systems using FFT Algorithms– Inverse DFT using FFT Algorithm.

**UNIT III INFINITE IMPULSE RESPONSE FILTERS 9**

Frequency response of Analog and Digital IIR filters–Realization of IIR filter–Design of analog low pass filter–Analog to Digital filter Transformation using Bilinear Transformation and Impulse Invariant method–Design of digital IIR filters (LPF, HPF, BPF, and BRF) using various transformation techniques.

**UNIT IV FINITE IMPULSE RESPONSE FILTERS 9**

Linear Phase FIR filter–Phase delay–Group delay–Realization of FIR filter–Design of Causal and Non-causal FIR filters (LPF, HPF, BPF and BRF) using Window method (Rectangular, Hamming window, Hanning window) –Frequency Sampling Technique.

**UNIT V APPLICATIONS OF DSP 9**

Multirate Signal Processing: Decimation, Interpolation, Spectrum of the sampled signal – Processing of Audio and Radar signal.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of the course, the students should be able to:

- Perform mathematical operations on signals.
- Understand the sampling theorem and perform sampling on continuous-time signals to get discrete time signal by applying advanced knowledge of the sampling theory.
- Transform the time domain signal into frequency domain signal and vice-versa.

- Apply the relevant theoretical knowledge to design the digital IIR/FIR filters for the given analog specifications.

**TEXT BOOK:**

1. John G. Proakis & Dimitris G.Manolakis, ―Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.

**REFERENCES**

1. Richard G. Lyons, ―Understanding Digital Signal Processing‖. Second Edition, Pearson Education.
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing‖, 8th Indian Reprint, Pearson, 2004.
3. Emmanuel C.Ifeachor, & Barrie.W.Jervis, ―Digital Signal Processing‖, Second Edition,Pearson Education / Prentice Hall, 2002.
4. William D. Stanley, ―Digital Signal Processing‖, Second Edition, Reston Publications.

**GE8075 INTELLECTUAL PROPERTY RIGHTS L T P C 3 0 0 3**

**Course Objectives:**

- To give an idea about IPR, registration and its enforcement.

**UNIT I INTRODUCTION 9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

**UNIT II REGISTRATION OF IPRs 10**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

**UNIT III AGREEMENTS AND LEGISLATIONS 10**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

**UNIT IV DIGITAL PRODUCTS AND LAW 9**

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

**UNIT V ENFORCEMENT OF IPRs 7**

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

**TOTAL : 45 PERIODS**

**Course Outcomes:**

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

**TEXT BOOKS:**

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. S. V. Satakar, —Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

**REFERENCES:**

1. Deborah E. Bouchoux, —Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets‖, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,‖Intellectual Property Rights: Unleashing the Knowledge Economy‖, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

**CS8091 BIG DATA ANALYTICS L T P C 3 0 0 3**

**Course Objectives:**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

**UNIT I INTRODUCTION TO BIG DATA 9**

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics – Validating The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

**UNIT II CLUSTERING AND CLASSIFICATION 9**

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes‘ Theorem - Naïve Bayes Classifier.

**UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM 9**

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association& finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

**UNIT IV STREAM MEMORY 9**

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

**UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION 9**

NoSQL Databases : Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding –- Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs- Review of Basic Data Analytic Methods using R.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

**TEXT BOOKS:**

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

**REFERENCES:**

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.
5. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

**CS8082 MACHINE LEARNING TECHNIQUES L T P C 3 0 0 3**

**Course Objectives:**

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

**UNIT I INTRODUCTION 9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

**UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

**UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

**UNIT IV INSTANT BASED LEARNING 9**

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

**UNIT V ADVANCED LEARNING 9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Discuss the decision tree algorithm and indentity and overcome the problem of overfitting
- Discuss and apply the back propagation algorithm and genetic algorithms to various problems
- Apply the Bayesian concepts to machine learning
- Analyse and suggest appropriate machine learning approaches for various types of problems

**TEXT BOOK:**

1. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education ( India) Private Limited, 2013 .

**REFERENCES:**

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning)‖, The MIT Press 2004.
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective‖, CRC Press, 2009.

**CS8092 COMPUTER GRAPHICS AND MULTIMEDIA L T P C 3 0 0 3**

**Course Objectives:**

- To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- To become familiar with various software programs used in the creation and implementation of multi- media

- To appreciate the importance of technical ability and creativity within design practice.
- To gain knowledge about graphics hardware devices and software used.
- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics

**UNIT I ILLUMINATION AND COLOR MODELS 9**

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection. Output primitives – points and lines, line drawing algorithms, loading the frame buffer,line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

**UNIT II TWO-DIMENSIONAL GRAPHICS 9**

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; window-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

**UNIT III THREE-DIMENSIONAL GRAPHICS 9**

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

**UNIT IV MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING 9**

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies.

**UNIT V HYPERMEDIA 9**

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems. CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling –
Shading & Textures

**TOTAL:45 PERIODS**

**Course Outcomes:**

At the end of the course, the students should be able to:

- Design two dimensional graphics.
- Apply two dimensional transformations.
- Design three dimensional graphics.
- Apply three dimensional transformations.
- Apply Illumination and color models.
- Apply clipping techniques to graphics.
- Understood Different types of Multimedia File Format
- Design Basic 3d Scenes using Blender

**TEXT BOOKS:**

1. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007 [ UNIT I – III ]
2. Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design‖, PHI, 2003. [ UNIT IV,V ]

**REFERENCES**:

1. Judith Jeffcoate, ―Multimedia in practice: Technology and Applications‖, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice‖, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, ―Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, ―Fundamentals of Computer Graphics‖, CRC Press, 2010.
6. William M. Newman and Robert F.Sproull, ―Principles of Interactive Computer Graphics‖, Mc Graw Hill 1978.https://www.blender.org/support/tutorials/

**IT8075 SOFTWARE PROJECT MANAGEMENT L T P C 3 0 0 3**

**Course Objectives:**

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization‘s strategic goals.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic programManagement – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring– Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS 9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtualteams – Communications genres – Communication plans – Leadership.

**TOTAL 45 PERIODS**

**Course Outcomes:**

At the end of the course, the students should be able to:

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
- Learn staff selection process and the issues related to people management

**TEXT BOOK:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES:**

1. Robert K. Wysocki ―Effective Software Project Management‖ – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management‖- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.

**CS8081 INTERNET OF THINGS L T P C 3 0 0 3**

**Course Objectives:**

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

**UNIT I FUNDAMENTALS OF IoT 9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack –– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

**UNIT II IoT PROTOCOLS 9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**UNIT III DESIGN AND DEVELOPMENT 9**

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning– No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

**TEXTBOOK:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

**REFERENCES:**

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things‖, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

https://www.arduino.cc/
https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet

**IT8074 SERVICE ORIENTED ARCHITECTURE L T P C 3 0 0 3**

**Course Objectives:**

- To learn fundamentals of XML
- To provide an overview of Service Oriented Architecture and Web services and their importance
- To learn web services standards and technologies
- To learn service oriented analysis and design for developing SOA based applications

**UNIT I XML 9**

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath - XML Transformation and XSL – Xquery

**UNIT II SERVICE ORIENTED ARCHITECTURE (SOA) BASICS 9**

Characteristics of SOA, Benefits of SOA , Comparing SOA with Client-Server and Distributed architectures –-- Principles of Service Orientation – Service layers

**UNIT III WEB SERVICES (WS) AND STANDARDS 8**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography

**UNIT IV WEB SERVICES EXTENSIONS 8**

WS-Addressing - WS-ReliableMessaging - WS-Policy – WS-Coordination – WS -Transactions - WS-Security - Examples

**UNIT V SERVICE ORIENTED ANALYSIS AND DESIGN 11**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design–Standards and composition guidelines -- Service design – Business process design – Case Study

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Understand XML technologies
- Understand service orientation, benefits of SOA
- Understand web services and WS standards
- Use web services extensions to develop solutions
- Understand and apply service modeling, service oriented analysis and design for application development

**TEXTBOOKS:**

1. Thomas Erl, ― Service Oriented Architecture: Concepts, Technology, and Design‖, Pearson Education, 2005
2. Sandeep Chatterjee and James Webber, ―Developing Enterprise Web Services: An Architect's Guide‖, Prentice Hall, 2004

**REFERENCES:**

1. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, ―Java Web Services Architecture‖, Elsevier, 2003.
2. Ron Schmelzer et al. ― XML and Web Services‖, Pearson Education, 2002.
3. Frank P.Coyle, ―XML, Web Services and the Data Revolution‖, Pearson Education, 2002

**GE8077 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3**

**Course Objectives:**

- To facilitate the understanding of Quality Management principles and process.

**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES 9**

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS AND TECHNIQUES I 9**

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

**UNIT IV TQM TOOLS AND TECHNIQUES II 9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM 9**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration- ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

**TEXT BOOK:**

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, ―Total Quality Management‖, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

**REFERENCES:**


1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO9001-2015 standards


**CS8083 MULTI-CORE ARCHITECTURES AND PROGRAMMING L T P C 3 0 0 3**

**Course Objectives**:

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms,
- To develop multicore programs and design parallel solutions.

**UNIT I MULTI-CORE PROCESSORS 9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

**UNIT II PARALLEL PROGRAM CHALLENGES 9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

**UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP 9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

**UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

**UNIT V PARALLEL PROGRAM DEVELOPMENT 9**

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

At the end of the course, the students should be able to:

- Describe multicore architectures and identify their characteristics and challenges.
- Identify the issues in programming Parallel Processors.
- Write programs using OpenMP and MPI.
- Design parallel programming solutions to common problems.
- Compare and contrast programming for serial processors and programming for parallel processors.

**TEXT BOOKS:**

1. Peter S. Pacheco, ―An Introduction to Parallel Programming‖, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, ―Multicore Application Programming for Windows, Linux, and Oracle Solaris‖, Pearson, 2011 (unit 2)

**REFERENCES:**

1. Michael J Quinn, ―Parallel programming in C with MPI and OpenMP‖, Tata McGraw Hill,2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

**CS8079 HUMAN COMPUTER INTERACTION L T P C 3 0 0 3**

**Course Objectives**:

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.

**UNIT I FOUNDATIONS OF HCI 9**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices– Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

**UNIT II DESIGN & SOFTWARE PROCESS 9**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

**UNIT III MODELS AND THEORIES 9**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT IV MOBILE HCI 9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

**UNIT V WEB INTERFACE DESIGN 9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Design effective dialog for HCI
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

**TEXT BOOKS:**


1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, ―Mobile Design and Development‖, First Edition, O‘Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, ―Designing Web Interfaces‖, First Edition, O‘Reilly, 2009. (UNIT-V)


**CS8073 C# AND .NET PROGRAMMING L T P C 3 0 0 3**

**Course Objectives:**

- To learn basic programming in C# and the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework.
- To understand the working of base class libraries, their operations and manipulation of data using XML.

**UNIT I C# LANGUAGE BASICS 9**

.Net Architecture - Core C# - Variables - Data Types - Flow control - Objects and Types- Classes and Structs - Inheritance- Generics – Arrays and Tuples - Operators and Casts – Indexers

**UNIT II C# ADVANCED FEATURES 9**

Delegates - Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Strings and Regular Expressions - Generics - Collections - Memory Management and Pointers - Errors and Exceptions – Reflection

**UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9**

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

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

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

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

Assemblies - Shared assemblies - Custom Hosting with CLR Objects - Appdomains - Core XAML - Bubbling and Tunneling Events- Reading and Writing XAML - .Net Compact Framework - Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Write various applications using C# Language in the .NET Framework.
- Develop distributed applications using .NET Framework.
- Create mobile applications using .NET compact Framework.

**TEXT BOOKS:**

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner. ―Professional C# 2012 and .NET 4.5‖, Wiley, 2012
2. Harsh Bhasin, ―Programming in C#‖, Oxford University Press, 2014.

**REFERENCES**

1.. Ian Gariffiths, Mathew Adams, Jesse Liberty, ―Programming C# 4.0‖, O_Reilly, Fourth Edition, 2010.

2.. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication,2012.

3.. Andy 3. Wigley, Daniel Moth, Peter Foot, ―Mobile Development Handbook‖, Microsoft Press, 2011.

**CS8088 WIRELESS ADHOC AND SENSOR NETWORKS L T P C 3 0 0 3**

**Course Objectives:**

- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about the Transport Layer protocols and their QoS for ad hoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solutions.

**UNIT I MAC & ROUTING IN AD HOC NETWORKS 9**

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols

**UNIT II TRANSPORT & QOS IN AD HOC NETWORKS 9**

TCP‟s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model

**UNIT III MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9**

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols

**UNIT IV TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9**

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor networks – Congestion Control in network processing – Operating systems for wireless sensor networks – examples

**UNIT V SECURITY IN AD HOC AND SENSOR NETWORKS 9**

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Identify different issues in wireless ad hoc and sensor networks .
- To analyze protocols developed for ad hoc and sensor networks .
- To identify and understand security issues in ad hoc and sensor networks.

**TEXT BOOKS:**

1. C.Siva Ram Murthy and B.S.Manoj, ―Ad Hoc Wireless Networks – Architectures and 2 Protocols‖, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, ―Protocols and Architectures for Wireless Sensor Networks‖, John Wiley & Sons, Inc., 2005.

**REFERENCES**

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, ―Ad Hoc Mobile Wireless Networks‖, Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, ―Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)‖, World Scientific Publishing, 2011.
3. Waltenegus Dargie, Christian Poellabauer, ―Fundamentals of Wireless Sensor Networks Theory and Practice‖, John Wiley and Sons, 2010
4. Xiang-Yang Li , "Wireless Ad Hoc and Sensor Networks: Theory and Applications‖, 1227 th edition, Cambridge university Press,2008.

**CS8071 ADVANCED TOPICS ON DATABASES L T P C 3 0 0 3**

**Course Objectives:**

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and their applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of advanced data models.
- To learn emerging databases such as XML, Cloud and Big Data.
- To acquire inquisitive attitude towards research topics in databases.

**UNIT I PARALLEL AND DISTRIBUTED DATABASES 9**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

**UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9**

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies.

**UNIT III INTELLIGENT DATABASES 9**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy-Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog-Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures- Spatial Access Methods- Spatial DB Implementation.

**UNIT IV ADVANCED DATA MODELS 9**

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Multimedia Databases- Information Retrieval- Data Warehousing- Data Mining- Text Mining.

**UNIT V EMERGING TECHNOLOGIES 9**

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases- Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages-Introduction to Big Data-Storage-Analysis.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

Upon Completion of the course, the students will be able,

- To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
- To understand and critique on each type of databases.
- To design faster algorithms in solving practical database problems.
- To implement intelligent databases and various data models.

**TEXT BOOKS:**


1. Ramez Elmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition , Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, ―Database Systems, A Practical Approach to Design, Implementation and Management‖, Fourth Edition, Pearson Education, 2008.

**REFERENCES:**


1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ―Advanced Database Systems‖, Morgan Kaufmann publishers,2006.


**GE8072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT** **L T P C 3 0 0 3**

**Course Objectives:**

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

**UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT** **9**

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

**UNIT II REQUIREMENTS AND SYSTEM DESIGN** **9**

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

**UNIT III DESIGN AND TESTING** **9**

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

**UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT** **9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal

**UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9**

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

**TEXTBOOKS:**


1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.


**REFERENCES:**


1. Hiriyappa B, ―Corporate Strategy – Managing the Business‖, Author House, 2013.
2. Peter F Drucker, ―People and Performance‖, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, ―Enterprise Resource Planning – Concepts‖, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design",McGraw Hill Education, Seventh Edition, 2013


**GE8074 HUMAN RIGHTS L T P C 3 0 0 3**

**Course Objectives :**

- To sensitize the Engineering students to various aspects of Human Rights.

**UNIT I 9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

**UNIT II** **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

**UNIT III** **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

**UNIT IV** **9**

Human Rights in India – Constitutional Provisions / Guarantees.

**UNIT V** **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO‘s, Media, Educational Institutions, Social Movements.

**TOTAL: 45 PERIODS**

**Course Outcome:**

- Engineering students will acquire the basic knowledge of human rights.

**REFERENCES:**


1. Kapoor S.K., ―Human Rights under International law and Indian Laws‖, Central Law Agency, Allahabad, 2014.
2. Chandra U., ―Human Rights‖, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.


**GE8071 DISASTER MANAGEMENT L T P C 3 0 0 3**

**Course Objectives:**

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability,
- disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential
- disaster response in areas where they live, with due sensitivity

**UNIT I INTRODUCTION TO DISASTERS** **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don‘ts during various types of Disasters.

**UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)** **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of-

community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

**UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

**UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

**UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

**TEXTBOOKS:**


1. Singhal J.P. ―Disaster Management‖, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN- 13: 978-9380386423
2. Tushar Bhattacharya, ―Disaster Science and Management‖, McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.


**REFERENCES**


1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

**EC8093 DIGITAL IMAGE PROCESSING L T P C 3 0 0 3**

**Course Objectives:**

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

**UNIT I DIGITAL IMAGE FUNDAMENTALS 9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

**UNIT II IMAGE ENHANCEMENT 9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

**UNIT III IMAGE RESTORATION 9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

**UNIT IV IMAGE SEGMENTATION 9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing-erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

**UNIT V IMAGE COMPRESSION AND RECOGNITION 9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

**TOTAL 45 PERIODS**

**Course Outcomes:**

At the end of the course, the students should be able to:

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.

- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

**TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.

**REFERENCES:**

1. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, _Digital Image Processing‘, John Wiley, New York, 2002
5. Milan Sonka et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

**CS8085 SOCIAL NETWORK ANALYSIS L T P C 3 0 0 3**

**Course Objectives:**

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

**UNIT I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis -Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and

communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

**TEXT BOOKS:**

1. Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.

**REFERENCES:**

1. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

**IT8073 INFORMATION SECURITY L T P C 3 0 0 3**

**Course Objectives:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

**UNIT I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT II SECURITY INVESTIGATION 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

**UNIT III SECURITY ANALYSIS 9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

**UNIT IV LOGICAL DESIGN 9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

**UNIT V PHYSICAL DESIGN 9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

**TOTAL 45 PERIODS**

**Course Outcomes:**

At the end of this course, the students should be able to:

- Discuss the basics of information security
- Illustrate the legal, ethical and professional issues in information security
- Demonstrate the aspects of risk management.
- Become aware of various standards in the Information Security System
- Design and implementation of Security Techniques.

**TEXT BOOK:**

1. Michael E Whitman and Herbert J Mattord, ―Principles of Information Security‖, Vikas Publishing House, New Delhi, 2003

**REFERENCES**

1. Micki Krause, Harold F. Tipton, ― Handbook of Information Security Management‖, Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, ―Hacking Exposed‖, Tata McGraw-Hill, 2003
3. Matt Bishop, ― Computer Security Art and Science‖, Pearson/PHI, 2002.

**CS8087 SOFTWARE DEFINED NETWORKS L T P C 3 0 0 3**

**Course Objectives:**

- To learn the fundamentals of software defined networks.
- To understand the separation of the data plane and the control plane.
- To study about the SDN Programming.

- To study about the various applications of SDN

**UNIT I INTRODUCTION 9**

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes

**UNIT II OPEN FLOW & SDN CONTROLLERS 9**

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

**UNIT III DATA CENTERS 9**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT IV SDN PROGRAMMING 9**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

**UNIT V SDN 9**

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Analyze the evolution of software defined networks
- Express the various components of SDN and their uses
- Explain the use of SDN in the current networking scenario
- Design and develop various applications of SDN

**TEXT BOOKS:**

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.

**REFERENCES:**

1. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

**CS8074 CYBER FORENSICS L T P C 3 0 0 3**

**Course Objectives:**

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

**UNIT I INTRODUCTION TO COMPUTER FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

**UNIT III ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

**UNIT IV ETHICAL HACKING 9**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing

**UNIT V ETHICAL HACKING IN WEB 9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**TOTAL 45 PERIODS**

**Course Outcomes:**

At the end of the course, the student should be able to:

- Understand the basics of computer forensics
- Apply a number of different computer forensic tools to a given scenario
- Analyze and validate forensics data
- Identify the vulnerabilities in a given network infrastructure
- Implement real-world hacking techniques to test system security

**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

**REFERENCES**

1. John R.Vacca, ―Computer Forensics‖, Cengage Learning, 2005
2. MarjieT.Britz, ―Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013.

3. AnkitFadia — Ethical Hacking‖ Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik —Insider Computer Fraud‖ Auerbach Publications Taylor & Francis Group–2008.

**CS8086 SOFT COMPUTING L T P C 3 0 0 3**

**Course Objectives:**

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
- To apply soft computing techniques to solve problems.

**UNIT I INTRODUCTION TO SOFT COMPUTING 9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

**UNIT III FUZZY SYSTEMS 9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

**UNIT IV GENETIC ALGORITHMS 9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

**UNIT V HYBRID SYSTEMS 9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.

**TEXT BOOKS:**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic

Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

**REFERENCES:**


1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.
2. Kwang H.Lee, ―First course on Fuzzy Theory and Applications‖, Springer, 2005.
3. George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications‖, Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2003.


**GE8076 PROFESSIONAL ETHICS IN ENGINEERING L T P C 3 0 0 3**

**Course Objectives:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES 10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS 9**

Senses of ‗Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR)– Discrimination.

**UNIT V GLOBAL ISSUES 8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

**Course Outcomes:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, ―Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, ―Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases‖, Cengage Learning, 2009.
3. John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers‖, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‗ Value Education', Vethathiri publications, Erode, 2011.

**Web sources:**

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

**CS8080 INFORMATION RETRIEVAL TECHNIQUES L T P C 3 0 0 3**

**Course Objectives:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**UNIT I INTRODUCTION 9**

Information Retrieval – Early Developments – The IR Problem – The User‗s Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT II MODELING AND RETRIEVAL EVALUATION 9**

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT III TEXT CLASSIFICATION AND CLUSTERING 9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy

and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT IV WEB RETRIEVAL AND WEB CRAWLING 9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V RECOMMENDER SYSTEM 9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Use an open source search engine framework and explore its capabilities
- Apply appropriate method of classification or clustering.
- Design and implement innovative features in a search engine.
- Design and implement a recommender system.

**TEXT BOOKS:**

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, ―Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, ―Recommender Systems Handbook‖, First Edition, 2011.

**REFERENCES:**

1. C. Manning, P. Raghavan, and H. Schütze, ―Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, ―Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**CS8078 GREEN COMPUTING L T P C 3 0 0 3**

**Course Objectives:**

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

**UNIT I FUNDAMENTALS 9**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT II GREEN ASSETS AND MODELING 9**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

**UNIT III GRID FRAMEWORK 9**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

**UNIT IV GREEN COMPLIANCE 9**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

**UNIT V CASE STUDIES 9**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- Enhance the skill in energy saving practices in their use of hardware.
- Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
- Understand the ways to minimize equipment disposal requirements .

**TEXT BOOKS:**


1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence‖, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012.


**REFERENCES:**


1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff/IBM rebook, 2011.
2. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry‖, Lulu.com, 2008
4. Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC Press


**CS8076 GPU ARCHITECTURE AND PROGRAMMING L T P C 3 0 0 3**

**Course Objectives:**

- To understand the basics of GPU architectures

- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models

**UNIT I GPU ARCHITECTURE 12**

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

**UNIT II CUDA PROGRAMMING 8**

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

**UNIT III PROGRAMMING ISSUES 8**

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

**UNIT IV OPENCL BASICS 8**

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

**UNIT V ALGORITHMS ON GPU 9**

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

**TOTAL: 45 PERIODS**

**Course Outcomes:**

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

- Describe GPU Architecture
- Write programs using CUDA, identify issues and debug them
- Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
- Write simple programs using OpenCL
- Identify efficient parallel programming patterns to solve problems

**TEXT BOOKS:**


1. Shane Cook, CUDA Programming: ―A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, ―Heterogeneous computing with OpenCL‖, 3rd Edition, Morgan Kauffman, 2015.


**REFERENCES:**


1. Nicholas Wilt, ―CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison - Wesley, 2013.
2. Jason Sanders, Edward Kandrot, ―CUDA by Example: An Introduction to General Purpose GPU Programming‖, Addison - Wesley, 2010.
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. http://www.nvidia.com/object/cuda_home_new.html
5. http://www.openCL.org

**CS8084 NATURAL LANGUAGE PROCESSING L T P C 3 0 0 3**

**Course Objectives:**

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

**UNIT I INTRODUCTION 9**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

**UNIT II WORD LEVEL ANALYSIS 9**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

**UNIT III SYNTACTIC ANALYSIS 9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

**UNIT IV SEMANTICS AND PRAGMATICS 10**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

**UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 8**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

**TOTAL :45 PERIODS**

**Course Outcomes:**

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

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications

- To compare and contrast the use of different statistical approaches for different types of NLP applications.

**TEXT BOOKS:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009.

**REFERENCES:**

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Java‖, O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008.

**CS8001 PARALLEL ALGORITHMS L T P C 3 0 0 3**

**Course Objectives:**

- To understand different parallel architectures and models of computation.
- To introduce the various classes of parallel algorithms.
- To study parallel algorithms for basic problems.
-

**UNIT I INTRODUCTION 9**

Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

**UNIT II PRAM ALGORITHMS 9**

Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring - Graph Searching.

**UNIT III SIMD ALGORITHMS -I 9**

2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication.

**UNIT IV SIMD ALGORITHMS -II 9**

Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction-Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree

**UNIT V MIMD ALGORITHMS 9**

UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.

**TOTAL : 45 PERIODS**

**Course Outcomes:**

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

- Develop parallel algorithms for standard problems and applications.
- Analyse efficiency of different parallel algorithms.

**TEXT BOOKS:**


1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition , 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming ", PHI learning, 2016.


**REFERENCES:**


1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning , 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.


**IT8077 SPEECH PROCESSING L T P C 3 0 0 3**

**Course Objectives:**

- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- Perform wavelet analysis of speech
- To understand the concepts of speech recognition

**UNIT I INTRODUCTION 9**

Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams

**UNIT II SPEECH MODELLING 9**

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation- based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling

**UNIT III SPEECH PRONUNCIATION AND SIGNAL PROCESSING 9**

Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology

**UNIT IV SPEECH IDENTIFICATION 9**

Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis – evaluation.

**UNIT V SPEECH RECOGNITION 9**

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (_stack‘) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans

**TOTAL :45 PERIODS**

**Course Outcomes:**

On Successful completion of the course ,Students will be able to

- Create new algorithms with speech processing
- Derive new speech models
- Perform various language phonetic analysis
- Create a new speech identification system
- Generate a new speech recognition system

**TEXT BOOK:**

1. Daniel Jurafsky and James H. Martin, — Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, Person education,2013.

**REFERENCES**

1. Kai-Fu Lee, —Automatic Speech Recognition‖, The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, —Soft Computing Implementation of Automatic Speech Recognition‖,LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, —Speech Recognition: Theory and C++ implementation‖,Wiley publications 2008.
4. Ikrami Eldirawy , Wesam Ashour, —Visual Speech Recognition‖, Wiley publications , 2011

**GE8073 FUNDAMENTALS OF NANOSCIENCE L T P C 3 0 0 3**

**Course Objectives:**

- To learn about basis of nanomaterial science, preparation method, types and application

**UNIT I INTRODUCTION 8**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires- ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II GENERAL METHODS OF PREPARATION 9**

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III NANOMATERIALS 12**

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc- growth, laser ablation, CVD routes, Plasma CVD), structure-property

Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

**UNIT IV CHARACTERIZATION TECHNIQUES 9**

X- ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

**UNIT V APPLICATIONS 7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

**TOTAL: 45 PERIODS**

Course Outcomes:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

**TEXT BOOKS :**

1. A.S. Edelstein and R.C. Cammearata, eds., ―Nanomaterials: Synthesis, Properties and Applications‖, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, ―Nanoscale Charecterisation of surfaces & Interfaces‖, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

**REFERENCES:**

1. G Timp, ―Nanotechnology‖, AIP press/Springer, 1999.
Akhlesh Lakhtakia,―The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations‖. Prentice-Hall of India (P) Ltd, New Delhi, 200