

ACADEMIC REGULATIONS
COURSE STRUCTURE AND DETAILED SYLLABUS
(CHOICE BASED CREDIT SYSTEM (CBCS))

MASTER OF TECHNOLOGY
IN
COMPUTER SCIENCE AND ENGINEERING

For

M.Tech. - Regular Two Year Post Graduate Degree Programme
(Applicable for the batches admitted from 2017 - 2018)



CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUH & Accredited by NBA
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FOREWORD

CMR Institute of Technology, established in the year 2005 has been bestowed with autonomous status by the UGC from the academic year 2017-18 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

CMR Institute of Technology takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the college and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Principal to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering graduates.

PRINCIPAL

CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

Mission: Impart global quality technical education for a better future by providing appropriate learning environment through continuous improvement and customization.

Quality Policy: Strive for global excellence in academics & research to the satisfaction of students and stakeholders.

Department of CSE

Vision:

“To be a model for academic excellence and research”

Mission:

- Impart fundamentals through state of art technologies for research and career in Computer Science and Engineering.
- Create value-based, socially committed professionals for anticipating and satisfying fast changing societal requirements.
- Foster continuous self learning abilities through regular interaction with various stakeholders for holistic development.

M.Tech. - Regular Two Year Post Graduate Degree Programme (For batches admitted from the academic year 2017 - 18)

PREAMBLE

For pursuing M.Tech. - Regular Two Year Post Graduate Degree Programme offered by **CMR Institute of Technology (CMRIT)** under Autonomous status will herein be referred to as CMRIT (Autonomous).

All the specified rules are herein approved by the Academic Council. These rules will be in force and are applicable to students admitted from the academic year 2017-18 onwards. Any reference to “**Institute**” or “**College**” in these rules and regulations stand for CMRIT (Autonomous).

All the rules and regulations specified shall hereafter be read as a whole for the purpose of interpretation, as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, CMRIT (Autonomous) shall be The Chairman, Academic Council.

1. POST GRADUATE PROGRAMS OFFERED

CMR Institute of Technology, an autonomous college affiliated to JNTUH, offers M.Tech. - Regular 2 years (4 semesters) Post Graduate Degree Programme, under Choice Based Credit System (CBCS) with effect from the academic year 2017 - 18 onwards. The following specializations are offered at present for the M. Tech. programme of study.

Sl. No.	Programme	Offering Department
1	Structural Engineering	Civil Engineering
2	CAD/CAM	Mechanical Engineering
3	VLSI System Design	Electronics & Communication Engineering
4	Computer Science and Engineering	Computer Science and Engineering

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

2.1. Admission into first year of M.Tech. - Regular Two Year Post Graduate Degree Programme

2.1.1 Eligibility: A candidate seeking admission into the first year of M.Tech. shall be made subject to eligibility and qualification as prescribed by the university from time to time. Admissions shall be made on the basis of merit/rank obtained by the candidate qualified at TSPGECET/GATE or any entrance test conducted by the university or on the basis of any other order of merit as approved by the university, subject to reservations as laid down from time to time by government of Telangana.

2.1.2 Admission Procedure: Admissions are made into the first year M.Tech. as per the stipulations of the TSPGECET/GATE.

- (a) Category A: 70% seats are filled through TSPGECET/GATE counselling.
- (b) Category B: 30% seats are filled by the management.

2.2. College Transfers: There shall be no college transfers after the completion of admission process.

2.3. Medium of Instruction: The medium of instruction and examinations for the entire M.Tech. - Programme will be in **English** only.

3. M.Tech. PROGRAMME STRUCTURE

3.1 Admitted under M.Tech. - Regular Two Year Post Graduate Degree Programme:

3.1.1 A student after securing admission shall pursue the post graduate programme in M.Tech. Programme for a minimum period of two academic years (4 semesters), and a maximum period of four academic years (8 semesters) starting from the date of commencement of first year first semester. However, he is permitted to write the examinations for two more years after four academic years of course work, failing which he shall forfeit his seat in M.Tech. Programme.

3.1.2 Each semester of I year are structured to provide 28 credits and each semester of II year are structured to provide 16 credits totaling to 88 credits for the entire M.Tech. Programme.

3.1.3 Each student shall secure 88 credits (with CGPA ≥ 5) required for the completion of the post graduate programme and award of the M.Tech. degree.

3.2 UGC/AICTE specified definitions/ descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/ norms, which are listed below.

3.2.1 Semester Scheme:

M.Tech. (Regular) Programme is of 2 academic years (4 semesters) with the academic year being divided into two semesters of 22 weeks (≥ 90 instructional days) each, each semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)', Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and curriculum/course structure as suggested by AICTE / JNTUH.

3.2.2 Credit Courses:

a) All subjects/courses are to be registered by a student in a semester to earn credits. Credits shall be assigned to each subject/course in a L : P : C (Lecture Periods: Practical Periods : Credits) structure, based on the following general pattern.

- One Credit - for One hour/Week/Semester for Theory/Lecture (L) Courses; and
- One Credit - for Two hours/Week/Semester for Laboratory/Practical (P) Courses

b) Contact Hours: Weekly contact hours - equal to 32 hours per week (i.e. 1 hour = 60 Minutes); for this an average course load of 28 credits per semester in first year and 16 credits per semester in second year.

4. COURSE REGISTRATION

4.1 A 'Faculty Advisor or Counsellor' shall be assigned to each students, who advises the student about the M.Tech. Programme, its course structure and curriculum, choice/option for subjects/courses, based on his/her competence, progress, and interest.

4.2 Academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring 'date and time stamping'. The online registration requests for any 'current semester' shall be completed before the commencement of Semester End Examinations (SEE) of the 'preceding semester'.

4.3 A student can apply for online registration, only after obtaining the written approval from his faculty advisor or counselor, which should be submitted to the College Academic Section through the Head of the Department. A copy of it shall be retained with the Head of the Department, the faculty advisor and the student.

- 4.4 A student may be permitted to register for his/her subjects/course of **choice** with a total of 28 credits per semester of first year (Minimum of 24 credits and Maximum of 32 credits, permitted deviation being $\pm 15\%$), based on his **progress** and SGPA/CGPA, and completion of the '**pre-requisites**' as indicated for various subjects/courses, in the department course structure and syllabus contents. However, a minimum of 24 credits per semester must be registered to ensure the studentship in any semester.
- 4.5 Choice for 'additional subjects / courses' to reach the maximum permissible limit of 32 credits (above the typical 28 credit norm) must be clearly indicated, which needs the specific approval and signature of the faculty advisor/counsellor.
- 4.6 If the student submits ambiguous choices or multiple options or erroneous (incorrect) entries during **online** registration for the subject(s)/course(s) under a given/specified course group/category as listed in the course structure, only the first mentioned subject/course in that category will be taken into consideration.
- 4.7 Subject/course options exercised through **online** registration are final and **cannot** be changed or inter-changed; further, alternate choices will not be considered. However, if the subject/course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the Head of the Department, with due notification and time-framed schedule, within the **first week** from the commencement of class-work for that semester.
- 4.8 Dropping of subjects/courses may be permitted, only after obtaining prior approval from the faculty advisor / counselor (subject to retaining a minimum of 24 credits), '**within 15 Days of time**' from the commencement of that semester.
- 4.9 **Open Electives:** Students have to choose open elective-1 in I year I semester and open elective-2 in I year II semester from the open electives list as per course structure.
- 4.10 **Core Electives:** Students have to choose two core electives (Core Elective-I and Core Elective-II) in I year I semester and another two core electives (Core Elective-III and Core Elective-IV) in I year II semester from the core electives list as per course structure.

5. SUBJECTS / COURSES TO BE OFFERED

- 5.1 A Subject/Course may be offered to the Students, **if only** a minimum of 1/3 of students register to the course.
- More than **one faculty member** may be allotted by the department for offer the **same subject** (lab/practical's may be included with the corresponding theory subject in the same semester) in any semester. However, selection choice for students will be based on '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **online entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).
 - If more entries for registration of a subject come into picture, then the concerned Head of the Department shall take necessary decision, whether or not to offer such a subject/course for **two (or multiple) sections**.

6. ATTENDANCE REQUIREMENTS

- 6.1 A Student shall be eligible to appear for the Semester End Examination (SEE) of any Subject / Course, if he acquires a minimum of 75% of attendance in that Subject / Course for that Semester.

- 6.2 A Student's Seminar Report and Seminar Presentation shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Seminar Presentation Classes during that Semester.
- 6.3 Condoning of shortage of attendance up to 10% (65% and above, and below 75%) in each Subject / Course of a Semester may be granted by the College Academic Council on genuine and valid grounds, based on the Student's representation with supporting evidence.
- 6.4 A stipulated fee per Subject / Course shall be payable towards condoning of shortage of attendance.
- 6.5 Shortage of Attendance below 65% in any Subject / Course shall in **NO** case be condoned.
- 6.6 A Student, whose shortage of attendance is not condoned in any Subject(s) / Course (s) or seminar in any Semester, is considered as 'Detained in that Subject(s)/ Course(s)' or seminar, and is not eligible to take Semester End Examination(s) of such Subject(s) (and in case of Seminars, his Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he has to seek Re-registration for those Subject(s) / Course (s) in subsequent Semesters, and attend the same as and when offered.
- 6.7 A candidate shall put in a minimum required attendance at least three (3) theory subjects in each semester for promoting to next semester. In order to qualify for the award of the MTech Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.
- 6.8 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next.
- 6.9 If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for **readmission into the same class**.

7. **ACADEMIC REQUIREMENTS**

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 6.

- 7.1 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to each Subject/ Course, if he secures not less than 40% Marks (28 out of 70 Marks) in the End Semester Examination, and a minimum of 50% of Marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing B Grade or above in that Subject.
- 7.2 A Student shall be deemed to have satisfied the Academic Requirements and earned the Credits allotted to - Seminar, and Comprehensive Viva-voce, if he secures not less than 50% of the total Marks to be awarded for each. The Student would be treated as failed, if he - (i) does not attend the Comprehensive Viva-voce as per the schedule given, or (ii) does not present the Seminar as required, or (iii) secures less than 50% of Marks (< 50 Marks) in Seminar/ Comprehensive Viva-voce evaluations. He may reappear for comprehensive viva where it is scheduled again; for seminar, he has to reappear in the next subsequent Semesters, as and when scheduled.
- 7.3 A Student shall register for all subjects covering 88 Credits as specified and listed in the Course Structure for the chosen M.Tech. Specialization, put up all the attendance and academic requirements for securing 88 Credits obtaining a minimum of B Grade or above in each Subject, and 'earn all 88 Credits securing SGPA \geq 5.0 (in each Semester) and final CGPA (ie, CGPA at the end of M.Tech. Programme) \geq 5.0, to successfully complete the M.Tech. Programme.

- 7.4** Marks and Letter Grades obtained in all those Subjects covering the above specified 88 credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card of II Year II Semester.
- 7.5** If a student registers for some more 'extra Subjects' (in the parent Department or other Departments/Branches of Engg.) other than those listed Subjects totaling to 88 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 88 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 6 and 7.1 – 7.4 above.
- 7.6** Students who fail to earn 88 Credits as per the specified Course Structure, and as indicated above, within 4 Academic Years from the date of Commencement of their I Year, shall forfeit their seats in M.Tech. Programme and their admissions shall stand cancelled.
- 7.7** When a student is detained due to shortage of attendance in any subject(s)/seminar in any semester, no Grade Allotment will be done for such Subject(s)/Seminar, and SGPA/ CGPA calculations of that Semester will not include the performance evaluations of such subject(s)/seminar in which he got detained. However, he becomes eligible for re-registration of such subject(s)/seminar (in which he got detained) in the subsequent Semester(s), as and when next offered, with the Academic Regulations of the Batch into which he gets readmitted, by paying the stipulated fees per subject. In all these re-registration cases, the student shall have to secure a fresh set of Internal Marks (CIE) and End Semester Examination Marks (SEE) for performance evaluation in such subject(s), and subsequent SGPA/ CGPA calculations.
- 7.8** A student eligible to appear in the Semester End Examination (SEE) in any subject, but absent at it or failed (failing to secure B Grade or above), may reappear for that subject at the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examination (SEE), for evaluating his performance in that Subject.

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

- 8.1** The performance of a student in each semester shall be evaluated subject-wise / course-wise (irrespective of credits assigned) with a maximum of 100 marks for theory. For all theory subjects/practicals, the distribution shall be 30 marks for CIE, and 70 marks for the SEE, and a letter grade corresponding to the percentage of marks obtained shall be given.

8.2 Evaluation of Theory Subjects / Courses

- A) Continuous Internal Evaluation:** For each theory subject there shall be two mid-term examinations of 30 marks. Each mid-term examination consists of subjective paper for 25 marks and assignment for 5 marks. The better performance out of these two mid-term examinations shall be taken as the final marks secured by the student. The duration of each mid term examination is for 120 minutes. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus as per the academic calendar.
- i) The subjective paper shall contain two parts i.e. Part A and Part B. Part A is compulsory question carries 10 marks for which there may be a 5 sub questions carries two mark each and Part B carries 15 marks for which there will be 3 essay questions with internal choice.

- ii) The student should submit first assignment before the commencement of the first mid term examinations, and second assignment before the commencement of the second mid-term examinations.

B) Semester End Examinations: The duration of SEE is 3 hours. The details of the question paper pattern are as follows:

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part- A** for 20 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory question which consists of ten sub-questions (two from each unit) carries 2 marks each.
- Part-B consists of five questions (numbered from 2 to 6) carries 10 marks each. One question from each unit with internal choice (i.e., a or b).

8.3 Evaluation of Practical Subjects/Courses: In any semester, a student has to complete all exercises in each practical/laboratory course and get the record certified by the concerned Head of the Department to be eligible for Semester End Examination. For practical/laboratory Subjects, there shall be a Continuous Internal Evaluation (CIE) during the semester for 30 internal marks and 70 marks for Semester End Examination (SEE).

A) Continuous Internal Evaluation (CIE): Out of the 30 marks, 15 marks are allocated for day-to-day work evaluation and for remaining 15 marks - two mid-term examinations of each 15 marks will be conducted by the concerned laboratory teacher for a duration of two hours and the better performance of the two mid-term examinations is taken into account.

B) Semester End Examination (SEE): The SEE for practical Subject / Course shall be conducted at the end of the semester by one Internal and one External Examiners appointed by the Head of the Institution as per the recommendation of the concerned Head of the Department.

8.4 Evaluation of Seminar: The student has to enroll and get approval for seminar on a specialized topic from the concerned Advisor / Counselor in the beginning of respective semester. There shall be two seminar presentations during I year I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to **reappear** during the supplementary examinations.

8.5 Evaluation of Comprehensive Viva: There shall be a comprehensive viva-voce in II year I semester. The comprehensive viva-voce is intended to assess the students' understanding of various subjects he has studied during the M.Tech. course of study. The Head of the Department shall be associated with the conduct of the comprehensive viva-voce through a Committee. The Committee shall consist of Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Head of the Institution. For this, the Head of the department shall submit a panel of 3 examiners through Controller of Examinations. There are no internal marks for the comprehensive viva-voce and evaluated for maximum of 100 marks. A candidate has to secure a minimum of 50% of total marks to be declared successful. If he fails to fulfill minimum marks, he has to **reappear** during the supplementary examinations.

8.6 Evaluation of Project Work:

- a) Every Student shall be required to execute his M.Tech. Project, under the guidance of the Supervisor assigned to him by the Head of the Department. The Project shall start immediately after the completion of the I Year II Semester, and shall continue through II Year I and II Semesters. The student shall carry out the literature survey, select an appropriate topic and submit a Project Proposal within 6 weeks (immediately after his I Year II Semester End Examinations), for approval by the Project Review Committee (PRC). The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department, Project Supervisor, and two senior faculty members of the department. The student shall present his project work proposal to the PRC (PRC-I Presentation), on whose approval he can '**REGISTER** for the Project'. Every Student must compulsorily register for his M.Tech. Project Work, within the 6 weeks of time-frame as specified above. After registration, the student shall carry out his work, and continually submit 'a fortnightly progress report' to his Supervisor throughout the Project period. The PRC will monitor the progress of the project Work and review, through PRC-II and PRC-III Presentations – one at the end of the II Year I Semester, and one before the submission of M.Tech. project work report/ dissertation.
- b) After PRC-III presentation, the PRC shall evaluate the entire performance of the Student and declare the Project Report as '**Satisfactory**' or '**Unsatisfactory**'. Every Project Work Report/ Dissertation (that has been declared 'satisfactory') shall undergo '**Plagiarism Check**' as per the University/ College norms to ensure content plagiarism below a specified level of **30%**, and to become acceptable for submission. In case of unacceptable plagiarism levels, the student shall resubmit the project work report, after carrying out the necessary modifications/ additions to his project work/ report as per his Supervisor's advice, within the specified time, as suggested by the PRC.
- c) If any student could not be present for PRC-II at the scheduled time (after approval and registration of his Project Work at PRC-I), his submission and presentation at the PRC-III time (or at any other PRC specified dates) may be treated as PRC-II performance evaluation, and delayed PRC-III dates for him may be considered as per PRC recommendations. Any Student is allowed to submit his MTech Project Dissertation '**only after completion of 40 weeks from the date of approval/registration**' of his Project, and after obtaining all approvals from the PRC.
- d) After approval of project registration through PRC-I, a project work review-I will be conducted at the end of II year I semester for 100 marks through CIE only. Out of 100 marks the concerned supervisor shall evaluate for 50 marks and remaining 50 marks by PRC-II. A candidate has to present and submit the project review-I report to the PRC-II. A candidate has to secure a minimum of 50% of total marks allotted. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.
- e) A project work review-II will be conducted at the end of II year II semester for 100 marks through CIE only. Out of 100 marks the concerned supervisor shall evaluate for 50 marks and remaining 50 marks by PRC-III. A candidate has to present and submit the project review-II report to the PRC-III. A candidate has to secure a minimum of 50% of total marks allotted. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.
- f) A total of 100 Marks are allotted for the M.Tech. Project Evaluation (Viva-Voce) SEE and there shall be no internal evaluation (CIE). The student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed M.Tech. Subjects (Theory and Labs.), Seminar, Comprehensive Viva-voce (securing B Grade or above), and after obtaining all approvals from PRC successfully. In such cases the M.Tech. dissertation will be sent to an External Examiner nominated by the Principal of the college, on whose 'approval', the student can appear for the M.Tech. Project Viva-voce Examination, which shall be conducted by **exam panel**, consisting of the project supervisor, Head of the Department and the External Examiner who adjudicated the Project Work and Dissertation. The **exam panel** shall jointly evaluate the performance for 100 Marks (SEE).

- g) If the adjudication report of the External Examiner is **‘not favourable’**, then the student shall revise and resubmit his Dissertation as per the time specified by the PRC. If the resubmitted report is again evaluated by the External Examiner as **‘not favourable’**, then that Dissertation will be summarily rejected. Subsequent actions for such Dissertations may be considered, only on the specific recommendations of the PRC.
- h) In cases, where the **exam panel** declared the Project Work Performance as **‘unsatisfactory’**, the student is deemed to have failed in the Project Viva-voce Examination, and he has to **reappear** for the Viva-voce Examination as per the **exam panel** recommendations. If he fails in the second Viva-voce Examination also, he will not be considered eligible for the Award of the Degree, unless he is asked to revise and resubmit his Project Work by the **exam panel** in a specified time (within 4 years from the date of commencement of his I Year I Semester).

9. GRADING PROCEDURE

- 9.1 Marks will be awarded to indicate the performance of each student in each theory subject, lab/practical's, comprehensive viva-voce and project work. Based on the percentage of marks obtained in CIE+SEE (Continuous Internal Evaluation plus Semester End Examination), both taken together, as specified in item 10, and a corresponding letter grade shall be given.
- 9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above	O (Outstanding)	10
Below 90% but not less than 80%	A ⁺ (Excellent)	9
Below 80% but not less than 70%	A (Very Good)	8
Below 70% but not less than 60%	B ⁺ (Good)	7
Below 60% but not less than 50%	B (Average)	6
Below 50% (< 50%)	F (Fail)	0
Absent	Ab	0

- 9.3 A student obtaining F grade in any subject/course shall be considered **‘failed’** and will be required to reappear as **‘Supplementary Candidate’** in the Semester End Examination (SEE), as and when offered. In such cases, his internal marks (CIE Marks) in those subject(s) will remain same as those he obtained earlier.
- 9.4 A Letter Grade does not imply any specific % of marks.
- 9.5 In general, a student shall not be permitted to repeat any subject/course (s) only for the sake of **‘Grade Improvement’** or **‘SGPA/CGPA Improvement’**. However, he has to repeat all the subjects/courses pertaining to that semester, when he is detained.
- 9.6 A student earns **Grade Point (GP)** in each Subject/Course, on the basis of the letter grade obtained by him in that subject/course (excluding Mandatory non-credit courses). Then the corresponding **‘Credit Points’ (CP)** are computed by multiplying the grade point with credits for that particular subject/course.

$$\text{Credit Points (CP)} = \text{Grade Point (GP)} \times \text{Credits ... For a Course}$$

- 9.7 The Student passes the subject/course only when he gets $GP \geq 5$ (B Grade or above).
- 9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from **all** subjects/courses **registered** in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places.

SGPA is thus computed as

$$SGPA = \left\{ \sum_{i=1}^N C_i G_i \right\} / \left\{ \sum_{i=1}^N C_i \right\} \dots \text{for each semester,}$$

where 'i' is the subject indicator index (takes into account all Subjects in a semester), 'N' is the no. of subjects '**registered**' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to that i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

- 9.9** The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all semesters considered for registration. The CGPA is the ratio of the total credit Points secured by a student in **all** registered Courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year II semester onwards, at the end of each semester, as per the formula

$$CGPA = \left\{ \sum_{j=1}^M C_j G_j \right\} / \left\{ \sum_{j=1}^M C_j \right\} \dots \text{for all S semesters registered}$$

(i.e., upto and inclusive of S semesters, $S \geq 2$)

where '**M**' is the total number of subjects (as specifically required and listed under the course structure of the parent department) the Student has '**registered**' from the I year I semester onwards upto and inclusive of the semester S (obviously $M > N$), 'j' is the subject indicator index (takes into account all Subjects from 1 to S semesters), is the no. of credits allotted to the j^{th} subject, and represents the Grade Points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I year I semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA					Illustration of calculation of CGPA			
Course /Subject	Credits	Letter Grade	Grade Points	Credit Points	Semester	Credits	SGPA	Credits x SGPA
Course 1	4	O	10	40	Sem I	28	7.00	196
Course 2	4	A ⁺	9	36	Sem II	28	6.00	168
Course 3	4	A	8	32	Sem III	16	6.50	104
Course 4	4	B ⁺	7	28	Sem IV	16	6.00	96
Course 5	4	B	6	24	Total	88		564
Course 6	4	F	0	0	CGPA=	6.41		
Total	24			160				
SGPA = 160/24 = 6.67								

- 9.10** For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.
- 9.11** For calculations listed in item 9.6 to 9.10, performance in failed subjects/courses (securing '**F**' grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations.

10 PASSING STANDARDS:

- 10.1** A student shall be declared '**successful**' or '**passed**' in a semester, if student secures a $GP \geq 6.00$ ('B' grade or above) in every subject/course in that semester (i.e. when student gets an $SGPA \geq 5.00$ at the end of that particular semester); and a student shall be declared '**successful**' or '**passed**' in the entire post graduate programme, only when gets a $CGPA \geq 5.00$ for the award of the degree as required.

10.2 After the completion of each semester, a ‘**Grade Card**’ or ‘**Grade Sheet**’ (or **Transcript**) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, number of credits, grade earned etc.), credits earned, SGPA, and CGPA.

10 DECLARATION OF RESULTS

11.1 Computation of SGPA and CGPA are done using the procedure in item Nos. 9.6 to 9.9.

11.2 For final percentage of marks equivalent to the computed final CGPA, the following formula may be used:

$$\text{Percentage of Marks} = (\text{final CGPA} - 0.5) \times 10$$

12 AWARD OF DEGREE

12.1 After a student has satisfied the requirement prescribed for the completion of the Program and is eligible for the award of M.Tech. Degree he shall be placed in one of the following four classes based on CGPA:

Class Awarded	Grade to be Secured	Remarks
First Class with Distinction	≥ 8.00 CGPA	From the aggregate marks secured from 88 credits for regular students
First Class	≥ 6.50 to < 8.00 CGPA	
Second Class	≥ 5.50 to < 6.50 CGPA	
Pass Class	≥ 5.00 to < 5.50 CGPA	

12.2 First Class with Distinction will be awarded to those students who clear all the subjects in single attempt during his/her regular course of study by fulfilling the following conditions:

- (i) Should have passed all the subjects/courses in ‘**first appearance**’ within the first 2 academic years (or 4 sequential semesters) for M.Tech.
- (ii) Should have secured a CGPA ≥ 8.00 , at the end of each of the 4 sequential semesters.
- (iii) Should not have been detained or prevented from writing the Semester End Examinations in any semester due to shortage of attendance or any other reason, shall be placed in ‘**First Class with Distinction**’.

12.3 **Award of Medals:** Students fulfilling the conditions listed under item 12.2 alone will be eligible for award of ‘**College ranks**’ and ‘**Medals**’.

12.4 **Transcripts:** After successful completion of prerequisite credits for the award of degree a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13 WITH HOLDING OF RESULTS

If the student has not paid the fee to college at any stage, or has dues pending against his/her name due to any reason what so ever, or if any case of indiscipline is pending against him/her, the result of the student may be withheld, and he/she will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subject(s) / course (s) shall be conducted along with even semester regular examinations and vice versa.

15. TRANSITORY REGULATIONS

- a) **Re-Registration for Detained Students:** When any Student is detained in a Subject (s)/ Seminar due to shortage of attendance in any Semester, he may be permitted to re-register for the same Subject in the 'same category' (Core or Elective Group) or equivalent Subject if the same Subject is not available, as suggested by the Board of Studies of that Department, as when offered in the sub-sequent Semester(s), with the Academic Regulations of the Batch into which he seeks re-registration, with prior permission from the concerned authorities, subject to Item 3.0.
- b) **Re-Admission for Discontinued Students:** Students, who have discontinued the M.Tech. Degree Programme due to any reasons what so ever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which he gets readmitted, with prior permission from the concerned authorities, subject to Item 3.0.
- c) A Student - who has discontinued for any reason, or who has been detained for want of attendance as specified, or who has failed after having undergone M.Tech. programme, may be considered eligible for readmission to the same programme with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and same Professional Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the timeframe of 4 years from the Date of Commencement of his I Year I Semester).

16 STUDENT TRANSFERS: There shall be no transfers from other colleges/streams.

17 RULES OF DISCIPLINE

- 17.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of controller of Examination for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.
- 17.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that subject(s) and grading is done accordingly.
- 17.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).
- 17.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Examiner is final.

18. MALPRACTICE

18.1 Malpractice Prevention Committee

A malpractice prevention committee shall be constituted to examine and punish the students who does malpractice / behaves indiscipline in examinations. The committee shall consist of:

- a) Controller of Examinations - Chairman
- b) Addl. Controller of Examinations.- Convener
- c) Subject Expert - Member
- d) Head of the Department of which the student belongs to - Member
- e) The Invigilator concerned - Member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

18.2 Malpractice Rules: Disciplinary action for improper conduct in examinations

S. No.	Nature of Malpractices / Improper Conduct	Punishment
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.	Expulsion from the examination hall and cancellation of the performance in that subject only.
1(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Principal.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police

		and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course

		by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the principal for further action to award suitable punishment.	

19. SCOPE

- i) The academic regulations should be read as a whole, for the purpose of any interpretation.
- ii) The above mentioned rules and regulations are applicable in general to M.Tech., unless and otherwise specific.
- iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the Academic Council Authorities.

COURSE STRUCTURE

CMR INSTITUTE OF TECHNOLOGY, HYDERABAD
(UGC AUTONOMOUS)
M.Tech. (COMPUTER SCIENCE AND ENGINEERING)
COURSE STRUCTURE

I Year – I Semester

	Course Title	Int. Marks	Ext. Marks	L	P	C
17CS1101CC	Data Structures and Algorithms	30	70	4	--	4
17CS1102CC	Database Internals	30	70	4	--	4
17CS1103CC	Distributed Systems	30	70	4	--	4
17CS1104CE	Network Security Android Application Development Cloud Computing Internet of Things	30	70	4	--	4
17CS1105CE	Machine Learning Parallel and Distributed Algorithms Software Architecture and Design Patterns Embedded Systems	30	70	4	--	4
17CS1106OE	Software Engineering E-Commerce Intellectual Property Rights	30	70	4	--	4
17CS1107CC	Data Structures and Algorithms Lab	30	70	--	4	2
17CS1108CC	Seminar	100	--	--	4	2
	Total			24	8	28

I Year – II Semester

	Course Title	Int. Marks	Ext. Marks	L	P	C
17CS1201CC	Network Programming	30	70	4	--	4
17CS1202CC	Information Retrieval Systems	30	70	4	--	4
17CS1203CC	Internet Technologies and Services	30	70	4	--	4
17CS1204CE	Data Mining Storage Area Networks Semantic Web and Social Networks Cyber Security	30	70	4	--	4
17CS1205CE	Big Data Analytics Soft Computing Software Process and Project Management Distributed Computing	30	70	4	--	4
17CS1206OE	Mobile Computing Social Media Intelligence Web Usability	30	70	4	--	4
17CS1207CC	Internet Technologies and Services Lab	30	70	--	4	2
17CS1208CC	Seminar	100	--	--	4	2
	Total			24	8	28

II Year - I Semester

	Course Title	Int. Marks	Ext. Marks	L	P	C
17CS2101CC	Comprehensive Viva-Voce	--	100	--	--	4
17CS2102CC	Project Work Review-I	100	--	--	24	12
	Total				24	16

II Year - II Semester

	Course Title	Int. Marks	Ext. Marks	L	P	C
17CS2201CC	Project Work Review-II	100	--	--	8	4
17CS2202CC	Project Evaluation (Viva-Voce)	--	100	--	16	12
	Total				24	16

DATA STRUCTURES AND ALGORITHMS**Objectives:****The student will know:**

- The fundamentals of basic data structures
- Basic concepts in the specification and analysis of programs
- Principles for good program design, especially the uses of data abstraction
- Significance of algorithms in the computer field
- Various aspects of algorithm development
- Qualities of a good solution

UNIT I

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples.

Data structures-Linear and non linear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays, Sparse matrices and their representation.

UNIT II

Stack and Queue ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, Dequeue ADT, array and linked list representations, Priority queue ADT, implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap, java.util package-ArrayList, Linked List, Vector classes, Stacks and Queues in java.util, Iterators in java.util.

UNIT III

Searching-Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util-HashMap, HashSet, Hashtable.

Sorting -Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

UNIT IV

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non recursive traversals, Java code for traversals, Threaded binary trees.

Graphs- Graphs terminology, Graph ADT, representations, graph traversals/search methods-dfs and bfs, Java code for graph traversals, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

UNIT V

Search trees- Binary search tree-Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees -Definition and examples only, B-Trees-definition, insertion and searching operations, Trees in java.util- TreeSet, Tree Map Classes, Tries(examples only),Comparison of Search trees. Text compression-Huffman coding and decoding, Pattern matching-KMP algorithm.

TEXT BOOKS:

1. Data structures, Algorithms and Applications in Java, S.Sahni, Universities Press.
2. Data structures and Algorithms in Java, Adam Drozdek, 3rd edn, Cengage Learning.
3. Data structures and Algorithm Analysis in Java, M.A.Weiss, 2nd ed, Addison-Wesley (Pearson Education)

REFERENCE BOOKS:

1. Java for Programmers, Deitel and Deitel, Pearson education.
2. Data structures and Algorithms in Java, R.Lafore, Pearson education.
3. Java: The Complete Reference, 8th edn, Herbert Schildt, TMH.
4. Data structures and Algorithms in Java, M.T.Goodrich, R.Tomassia, 3rd edn, Wiley India Edition.
5. Data structures and the Java Collection Frame work,W.J.Collins, Mc Graw Hill.
6. Classic Data structures in Java, T.Budd, Addison-Wesley (Pearson Education).
7. Data structures with Java, Ford and Topp, Pearson Education.
8. Data structures using Java, D.S.Malik and P.S.Nair, Cengage learning.
9. Data structures with Java, J.R.Hubbard and A.Huray, PHI Pvt. Ltd.
10. Data structures and Software Development in an Object-Oriented Domain, J.P.Tremblay and G.A.Cheston, Java edition, Pearson Education.

Outcomes:

After completion of this course, the student knows:

- The fundamentals of basic data structures
- Basic concepts in the specification and analysis of programs
- Principles for good program design, especially the uses of data abstraction
- Significance of algorithms in the computer field
- Various aspects of algorithm development
- Qualities of a good solution

DATABASE INTERNALS**Objectives:****The student will know:**

- History and Structure of databases
- How to design a database and convert into the appropriate tables
- Normalizing the tables to eliminate redundancies
- Querying relational data and processing the queries
- Storage Optimizing Strategies for easy retrieval of data through index
- Distributed databases management system concepts

UNIT I

Database System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas, Data Models – the ER Model, Relational Model, Other Models – Database Languages – DDL,DML, Database Access from Applications Programs, Transaction Management, Data Storage and Querying, Database Architecture, Database Users and Administrators, ER diagrams,. Relational Model: Introduction to the Relational Model – Integrity Constraints Over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views –Altering Tables and Views, Relational Algebra, Basic SQL Queries, Nested Queries, Complex Integrity Constraints in SQL, Triggers

UNIT II

Introduction to Schema Refinement – Problems Caused by redundancy, Decompositions – Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST, SECOND, THIRD Normal forms – BCNF –Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design – Multi valued Dependencies – FOURTH Normal Form, Join Dependencies, FIFTH Normal form.

UNIT III

Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions – Lock Based Concurrency Control, Deadlocks – Performance of Locking – Transaction Support in SQL.

Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques – Concurrency Control without Locking. Crash recovery: Introduction to Crash recovery, Introduction to ARIES, the Log, and Other Recovery related Structures, the Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery

UNIT IV

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing – Clustered Indexes, Primary and Secondary Indexes, Index data Structures – Hash Based Indexing, Tree based Indexing Storing data: Disks and Files: -The Memory Hierarchy – Redundant Arrays of Independent Disks. Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, and Delete.

Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendable Vs Linear Hashing.

UNIT V

Distributed databases: Introduction to distributed databases, Distributed DBMS architectures, Storing data in a distributed DBMS, Distributed catalog management, Distributed query processing Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed recovery

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw hill, VI edition, 2006.
3. Fundamentals of Database Systems 5th edition, Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2008.

REFERENCE BOOKS:

1. Introduction to Database Systems, C.J.Date, Pearson Education.
2. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, PHI.
3. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
4. Database Systems, A Practical approach to Design Implementation and Management Fourth edition, Thomas Connolly, Carolyn Begg, Pearson education.
5. Database-Principles, Programming, and Performance, P.O'Neil & E.O'Neil, 2nd edn, ELSEVIER
6. Fundamentals of Relational Database Management Systems, S.Sumathi, S.Esakkirajan, Springer.
7. Introduction to Database Management, M.L.Gillenson and others, Wiley Student Edition.
8. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
9. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
10. Principles of Distributed Database Systems, M. Tamer Ozsü, Patrick Valduriez, Pearson Education, 2nd edn.
11. Distributed Database Systems, Chhanda Ray, Pearson.

Outcomes:

After completion of this course, the student knows:

- History and Structure of databases
- How to design a database and convert into the appropriate tables
- Normalizing the tables to eliminate redundancies
- Querying relational data and processing the queries
- Storage Optimizing Strategies for easy retrieval of data through index
- Distributed databases management system concepts

DISTRIBUTED SYSTEMS**Objectives:****The student will know:**

- The need for distributed systems and their applications
- The concepts of remote procedure calls and remote method invocation
- Remote file systems implementation
- The concepts of distributed agreement
- The necessity of clock synchronization
- The concepts of security system

UNIT I

Characterization of Distributed Systems-Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models-Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication.

Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

UNIT II

Operating System Support- Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems.

Name Services- Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

UNIT III

Peer to Peer Systems-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore, Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging.

Coordination and Agreement-Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT IV

Transactions and Concurrency control-Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions-Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

UNIT V

Security-Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures, Case studies-Kerberos, TLS, 802.11 Wi-Fi.

Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, Other consistency models, CORBA case study-Introduction, CORBA RMI, CORBA Services.

TEXT BOOKS:

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems, S.Ghosh, Chapman& Hall/CRC, Taylor & Francis Group, 2010.

REFERENCE BOOKS:

1. Distributed Computing, S.Mahajan and S.Shah, Oxford University Press.
2. Distributed Operating Systems Concepts and Design, Pradeep K.Sinha, PHI.
3. Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, TMH.
4. Reliable Distributed Systems, K.P.Birman, Springer.
5. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
6. Distributed Operating Systems and Algorithm Analysis, R.Chow, T.Johnson, Pearson.
7. Distributed Operating Systems, A.S.Tanenbaum, Pearson education.
8. Distributed Computing, Principles, Algorithms and Systems, Ajay D.Kshemakalyani and Mukesh Singhal, Cambridge, rp 2010.

Outcomes:

After completion of this course, the student knows:

- The need for distributed systems and their applications.
- The concepts of remote procedure calls and remote method invocation
- Remote file systems implementation
- The concepts of distributed agreement
- The necessity of clock synchronization
- The concepts of security system

NETWORK SECURITY (Core Elective-I)

Objectives:

The student will know:

- The basic categories of threats to computers and networks
- Understand various cryptographic algorithms.
- The enhancements made to IPv4 by IPSec
- Intrusions and intrusion detection System
- Generate and distribute a PGP key pair and use the PGP package
- Web security and firewalls concepts

UNIT – I

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography: **Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT – II

Symmetric key Ciphers: Block Cipher principles & Algorithms(DES, AES, Blowfish), Differential and Linear Cryptanalysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution **Asymmetric key Ciphers:** Principles of public key cryptosystems, Algorithms(RSA, Diffie-Hellman, ECC), Key Distribution

UNIT – III

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm **Authentication Applications:** Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication

UNIT – IV

E-Mail Security: Pretty Good Privacy, S/MIME **IP Security:** IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, combining security associations, key management

UNIT – V

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction **Intruders, Virus and Firewalls:** Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls **Case Studies on Cryptography and security:** Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual Elections.

TEXT BOOKS:

1. Cryptography and Network Security : William Stallings, Pearson Education, 5th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 2nd Edition.
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1stEdn.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 2nd Edition
3. Information Security, Principles and Practice : Mark Stamp, Wiley India.
4. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.
6. Principles of Information security by Michael E Whitman and Herbert J.Mattord.

Outcomes:

After completion of this course, the student knows:

- The basic categories of threats to computers and networks
- Various cryptographic algorithms.
- The enhancements made to IPv4 by IPSec
- Intrusions and intrusion detection System
- Generate and distribute a PGP key pair and use the PGP package
- Web security and firewalls concepts

ANDROID APPLICATION DEVELOPMENT
(Core Elective -I)

Objectives:

The student will know:

- The fundamentals of Android operating systems
- The skills of using Android software development tools
- Development of software with reasonable complexity on mobile platform
- How to deploy software to mobile devices
- Debug of programs running on mobile device
- The basics of advanced topics like alarms, uses of internet resources and location based services

Unit I:

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes
Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

Unit II:

Android User Interface: Measurements – Device and pixel density independent measuring units Layouts – Linear, Relative, Grid and Table Layouts, User Interface (UI) Components – Editable and non editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers Event Handling – Handling clicks or changes of various UI components Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

Unit III:

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS, Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity, Notifications – Creating and Displaying notifications, Displaying Toasts

Unit IV:

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference, Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

Unit V:

Advanced Topics: Alarms – Creating and using alarms, Using Internet Resources – Connecting to internet resource, using download manager, Location Based Services – Finding Current Location and showing location on the Map, updating location

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

Outcomes:

After completion of this course, the student:

- The fundamentals of Android operating systems
- The skills of using Android software development tools
- Development of software with reasonable complexity on mobile platform
- How to deploy software to mobile devices
- Debug of programs running on mobile device
- The basics of advanced topics like alarms, uses of internet resources and location based services

**CLOUD COMPUTING
(Core Elective -I)****Objectives:****The student will know:**

- The new computing model, which enables shared resources on demand over the network.
- About the pay-per-use scenarios.
- About the new kind of service models and deployment models.
- About the virtualization technology.
- The python programming or various services and models.
- Development of cloud applications in Python

UNIT-I

Principles of Parallel and Distributed Computing, Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies, cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and Mapreduce.

UNIT –II

Cloud Platforms for Industry, Healthcare and education, Cloud Platforms in the Industry, cloud applications. Virtualization, cloud virtualization technology, deep dive: cloud virtualization, Migrating in to cloud computing, Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems

UNIT-III

Cloud computing Applications: Industry, Health, Education, Scientific Applications, Business and Consumer Applications, Understanding Scientific Applications for Cloud Environments, Impact of Cloud computing on the role of corporate IT.

Enterprise cloud computing Paradigm, Federated cloud computing Architecture, SLA Management in Cloud Computing, Developing the cloud: cloud application Design.

UNIT-IV

Python Basics, Python for cloud, cloud application development in python, Cloud Application Development in Python.

Programming Google App Engine with Python: A first real cloud Application, Managing Data in the cloud, Google app engine Services for Login Authentication, Optimizing UI and Logic, Making the UI Pretty: Templates and CSS, Getting Interactive. Map Reduce Programming Model and Implementations.

UNIT-V

Cloud management, Organizational Readiness and change management in the cloud age, Cloud Security, Data security in the cloud, Legal Issues in the Cloud, Achieving Production Readiness for the cloud Services

TEXT BOOKS:

1. Cloud Computing: Raj Kumar Buyya , James Broberg, andrzej Goscinski, 2013 Wiley
2. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola,selvi-2013.
3. Cloud Computing: Arshdeep Bahga, Vijay Madiseti, 2014, University Press.
4. Cloud computing: Dr Kumar Saurab Wiley India 2011.

REFERENCES:

1. Code in the Cloud: Mark C.Chu-Carroll 2011, SPD.(Second part of IV UNIT)
2. Essentials of cloud computing : K Chandrasekharan CRC Press.
3. Cloud Computing: John W. Rittinghouse, James Ransome, CRC Press.
4. Virtualization Security: Dave shackleford 2013. SYBEX a wiley Brand.
5. Cloud computing and Software Services: Ahson , Ilyas.2011.
6. Cloud Computing Bible: Sosinsky 2012. Wiley India .
7. Cloud Computing: Dan C. Marinescu-2013, Morgan Kaufmann.
8. Distributed and Cloud Computing, Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.
9. Fundamentals of Python, Kenneth A.Lambert, B.L.Juneja

Outcomes:

After completion of this course, the student knows:

- The new computing model, which enables shared resources on demand over the network.
- About the pay-per-use scenarios.
- About the new kind of service models and deployment models.
- About the virtualization technology.
- The python programming or various services and models.
- Development of cloud applications in Python

INTERNET OF THINGS (Core Elective -I)

Objectives:**The student will know:**

- The terminology, technology and its applications
- The concept of M2M (machine to machine) with necessary protocols
- The Python Scripting Language which is used in many IoT devices
- The Raspberry PI platform, that is widely used in IoT applications
- The implementation of web based services on IoT devices
- The cloud storage models

Unit I: Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and, Lifestyle

Unit II: IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Unit III: Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling
Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

Unit IV: IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C)
Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit V: IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

TEXT BOOK:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

Outcomes:**After completion of this course, the student knows:**

- The terminology, technology and its applications
- The concept of M2M (machine to machine) with necessary protocols
- The Python Scripting Language which is used in many IoT devices
- The Raspberry PI platform, that is widely used in IoT applications
- The implementation of web based services on IoT devices
- The cloud storage models

MACHINE LEARNING (Core Elective -II)

Objectives:

The student will know:

- How to formulate machine learning problems corresponding to different applications
- A range of machine learning algorithms along with their strengths and weaknesses
- To understand the basic theory underlying machine learning
- To apply machine learning algorithms to solve problems of moderate complexity
- The issues raised by current research
- The basics of genetic algorithms

UNIT I

INTRODUCTION - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning

Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

UNIT II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition

Advanced topics in artificial neural networks

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

UNIT III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm

Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning - **Instance-Based Learning**- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution

Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

UNIT V

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators,

Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995
4. Machine Learning by Peter Flach , Cambridge.

Outcomes:

After completion of this course, the student knows:

- How to formulate machine learning problems corresponding to different applications
- A range of machine learning algorithms along with their strengths and weaknesses
- The basic theory underlying machine learning
- How to apply machine learning algorithms to solve problems of moderate complexity
- The issues raised by current research
- The basics of genetic algorithms

PARALLEL AND DISTRIBUTED ALGORITHMS
(Core Elective –II)

Objectives:

The student will know:

- The various classes of parallel algorithms.
- The basics of parallel and distributed algorithms
- The uses of pipelining
- The basics of shared memory and message passing models.
- The complexity and correctness models for parallel algorithms.
- Implementation of sorting and numerical algorithms.

UNIT-I

Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing

UNIT-II

Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples

UNIT-III

Pipelining- Techniques computing platform, pipeline programs examples

UNIT-IV

Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallel sharing data parallel programming languages and constructs, open MP

UNIT-V

Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.

TEXT BOOK:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.

REFERENCE BOOK:

1. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

Outcomes:

After completion of this course, the student knows:

- The various classes of parallel algorithms.
- The basics of parallel and distributed algorithms
- The uses of pipelining
- The basics of shared memory and message passing models.
- The complexity and correctness models for parallel algorithms.
- Implementation of sorting and numerical algorithms.

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS**(Core Elective –II)****Objectives:****The student will know:**

- The concept of patterns and the Catalog.
- The design patterns and their affect on: sessions, client access, validation and consistency.
- The variety of bad practices related to the Business and Integration tiers.
- The evolution of patterns.
- How to add functionality to designs while minimizing complexity
- How to use design patterns to keep code quality high without overdesign.

UNIT I

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

Creating an Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT II

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT III

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage.

Creational and Structural patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT IV

Behavioral patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

UNIT V

Case Studies: A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development,

TEXT BOOKS:

1. Software Architecture in Practice, Len Bass, Paul Clements & Rick Kazman, 2nd Edn, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

REFERENCE BOOKS:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.
8. Pattern Oriented Software Architecture, F.Buschmann & others, John Wiley & Sons.

Outcomes:

After completion of this course, the student knows:

- The concept of patterns and the Catalog.
- The design patterns and their affect on: sessions, client access, validation and consistency.
- The variety of bad practices related to the Business and Integration tiers.
- The evolution of patterns.
- How to add functionality to designs while minimizing complexity
- How to use design patterns to keep code quality high without overdesign.

EMBEDDED SYSTEMS
(Core Elective -II)

Objectives:

The Student will know:

- Various embedded system applications and design requirements.
- Construction of embedded system hardware.
- Embedded programming concepts
- Development of software programs to control embedded system.
- Generation of product specification for embedded system.
- The basics of real-time operating systems.

UNIT I:

Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software, Complex System Design, Design Process in Embedded System, Formalization of System Design, Classification of Embedded Systems

UNIT II:

8051 and Advanced Processor Architecture: 8051 Architecture, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, Interrupts, Introduction to Advanced Architectures, Real World Interfacing, Processor and Memory organization

Devices and Communication Buses for Devices Network: Serial and parallel Devices & ports, Wireless Devices, Timer and Counting Devices, Watchdog Timer, Real Time Clock, Networked Embedded Systems, Internet Enabled Systems, Wireless and Mobile System protocols

UNIT III:

Embedded Programming Concepts: Software programming in Assembly language and High Level Language, Data types, Structures, Modifiers, Loops and Pointers, Macros and Functions, object oriented Programming, Embedded Programming in C++ & JAVA

UNIT IV

Real – Time Operating Systems: OS Services, Process and Memory Management, Real – Time Operating Systems, Basic Design Using an RTOS, Task Scheduling Models, Interrupt Latency, Response of Task as Performance Metrics

RTOS Programming: Basic functions and Types of RTOSes, RTOS VxWorks, Windows CE

UNIT V:

Embedded Software Development Process and Tools: Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-Desig.

Testing, Simulation and Debugging Techniques and Tools: Testing on Host Machine, Simulators, Laboratory Tools

TEXT BOOK:

1. Embedded Systems, Raj Kamal, Second Edition TMH.

REFERENCE BOOKS:

1. Embedded/Real-Time Systems, Dr.K.V.K.K.Prasad, dreamTech press
2. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Pearson.
3. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.
4. An Embedded Software Primer, David E. Simon, Pearson Education.
5. Micro Controllers, Ajay V Deshmukhi, TMH.
6. Microcontrollers, Raj kamal, Pearson Education.
7. Introduction to Embedded Systems, Shibu K.V, TMH.

Outcomes:

After completion of this course, the student:

- Various embedded system applications and design requirements.
- Construction of embedded system hardware.
- Embedded programming concepts
- Development of software programs to control embedded system.
- Generation of product specification for embedded system.
- The basics of real-time operating systems.

**SOFTWARE ENGINEERING
(Open Elective-I)****Objectives:****The student will know:**

- Software process models such as waterfall and evolutionary models
- The fundamentals of software requirements and SRS document
- About different software architectural styles
- Software testing approaches such as unit testing and integration testing
- How to ensure good quality software
- About risk management for software risks

UNIT I

Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, legacy software, Software myths.

A Generic view of process: Software engineering- A layered technology, a process framework, The Capability Maturity

Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

Process models: The waterfall model, Incremental process models, Evolutionary process models, specialized process models, The Unified process.

UNIT II

Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.

Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

System models: Context Models, Behavioral models, Data models, Object models, structured methods.

UNIT III

Design Engineering: Design process and Design quality, Design concepts, the design model, pattern based software design.

Creating an architectural design: software architecture, Data design, Architectural styles and patterns, Architectural

Design, assessing alternative architectural designs, mapping data flow into a software architecture.

Modeling component-level design: Designing class-based components, conducting component-level design, Object constraint language, designing conventional components.

Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

UNIT IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

Product metrics: Software Quality, Frame work for Product metrics, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance. Metrics for Process and Products: Software Measurement, Metrics for software quality.

UNIT V

Risk management: Reactive Vs Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

TEXT BOOKS:

1. Software Engineering A practitioner's Approach, Roger S Pressman, sixth edition,. McGraw Hill International Edition.
2. Software Engineering, Ian Sommerville, seventh edition, Pearson education.

REFERENCE BOOKS:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
2. Software Engineering : A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008. Fundamentals of Software Engineering, Rajib Mall, PHI, 2005.
3. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.
4. Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
5. Software Engineering2: Specification of systems and languages, Diner Bjorner, Springer International Edition, 2006.
6. Software Engineering Foundations, Yingxu Wang, Auerbach Publications, 2008.
7. Software Engineering Principles and Practice, Hans Van Vliet, 3rd edition, John Wiley & Sons Ltd.
8. Software Engineering 3: Domains, Requirements, and Software Design, D.Bjorner, Springer International Edition.
9. Introduction to Software Engineering, R.J.Leach, CRC Press.

Outcomes:

After completion of this course, the student knows:

- The basics of social media intelligence
- The fundamentals of opinion formation
- About opinion ecosystems
- How to manage social media communities for better social media intelligence
- Marketing research methods
- How to build a social media intelligence in to our strategies

E – COMMERCE
(Open Elective-I)

Objectives:

The student will know:

- The identification of the major categories and trends of e-commerce applications.
- The identification of the essential processes of an e-commerce system.
- The identification of several factors and web store requirements needed to succeed in e-commerce.
- The main technologies behind e-commerce systems and how these technologies interact.
- The various marketing strategies for an online business.
- The various electronic payment types and associated security risks and the ways to protect against them.

UNIT - I

Electronic Commerce- Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E- Commerce organization applications.

Consumer Oriented Electronic commerce - Mercantile Process models

UNIT - II

Electronic payment systems - Digital Token-Based Smart Cards, Credit Cards, Risks in Electronic Payment systems. Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.

UNIT - III

Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses.

UNIT- IV

Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering

UNIT - V

Multimedia - key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

TEXT BOOK:

1. Frontiers of electronic commerce – Kalakata, Whinston, Pearson.

REFERENCES BOOKS:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
2. E-Commerce, S.Jaiswal – Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
4. Electronic Commerce – Gary P.Schneider – Thomson.

Outcomes:

After completion of this course, the student knows:

- The identification of the major categories and trends of e-commerce applications.
- The identification of the essential processes of an e-commerce system.
- The identification of several factors and web store requirements needed to succeed in e-commerce.
- The main technologies behind e-commerce systems and how these technologies interact.
- The various marketing strategies for an online business.
- The various electronic payment types and associated security risks and the ways to protect against them.

INTELLECTUAL PROPERTY RIGHTS
(Open Elective-I)

Objectives:

The student will know:

- The significances of intellectual property laws
- About trade mark concept
- The requirement of copyright concept
- The concept of patent and its uses
- The basics of trade secret concept
- How the intellectual property rights affect the society development

Unit-I

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law Ethical obligations in Para Legal Tasks in Intellectual Property Law - Introduction to Cyber Law – Innovations and Inventions Trade related Intellectual Property Right

Unit-II

Introduction to Trade mark – Trade mark Registration Process – Post registration Procedures – Trade mark maintenance - Transfer of Rights - Inter partes Proceeding – Infringement - Dilution Ownership of Trade mark – Likelihood of confusion - Trademarks claims – Trademarks Litigations – International Trade mark Law

Unit-III

Introduction to Copyrights – Principles of Copyright Principles -The subjects Matter of Copy right – The Rights Afforded by Copyright Law – Copy right Ownership, Transfer and duration – Right to prepare Derivative works – Rights of Distribution – Rights of Perform the work Publicity Copyright Formalities and Registrations - Limitations - Copyright disputes and International Copyright Law – Semiconductor Chip Protection Act

Unit -IV

The law of patents-patent searches –Patent ownership and transfer-Patent infringement-International Patent Law

Unit-V

Introduction to Trade Secret – Maintaining Trade Secret – Physical Security – Employee Limitation - Employee confidentiality agreement - Trade Secret Law - Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law

TEXT BOOKS:

1. Debirag E. Bouchoux: “Intellectual Property”, 4e, Cengage learning, New Delhi
2. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections
4. Prabhuddha Ganguli, ‘Intellectual Property Rights’ Tata Mc-Graw –Hill, New Delhi
5. J Martin and C Turner, “Intellectual Property” CRC Press
6. Richard Stimm, “Intellectual Property” Cengage Learning

Outcomes:

After completion of this course, the student knows:

- The significances of intellectual property laws
- About trade mark concept
- The requirement of copyright concept
- The concept of patent and its uses
- The basics of trade secret concept
- How the intellectual property rights affect the society development

DATA STRUCTURES AND ALGORITHMS LAB

Objectives:

The student will know:

- The fundamental design, analysis, and implementation of basic data structures.
- The basic concepts in the specification and analysis of programs.
- The principles for good program design, especially the uses of data abstraction.
- How to write effective program for various data structures
- The basics of various implementation methods
- How to do the performance analysis of different programs.

Sample Problems on Data structures:

1. Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:
a) Linear search b) Binary search
2. Write Java programs to implement the following using arrays and linked lists a) List ADT
3. Write Java programs to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
5. Write a Java program to implement circular queue ADT using an array.
6. Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.
7. Write Java programs to implement the following using a singly linked list.
a) Stack ADT b) Queue ADT
8. Write Java programs to implement the deque (double ended queue) ADT using a) Array b) Singly linked list c) Doubly linked list.
9. Write a Java program to implement priority queue ADT.
10. Write a Java program to perform the following operations:
a) Construct a binary search tree of elements.
b) Search for a key element in the above binary search tree.
c) Delete an element from the above binary search tree.
11. Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
12. Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
13. Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in
a) Preorder b) Inorder c) Postorder.
14. Write Java programs for the implementation of bfs and dfs for a given graph.
15. Write Java programs for implementing the following sorting methods:
a) Bubble sort d) Merge sort g) Binary tree sort
b) Insertion sort e) Heap sort
c) Quick sort f) Radix sort
16. Write a Java program to perform the following operations:
a) Insertion into a B-tree b) Searching in a B-tree
17. Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
18. Write a Java program that implements KMP algorithm for pattern matching.

REFERENCE BOOKS:

1. Data Structures and Algorithms in java, 3rd edition, A.Drozdek, Cengage Learning.
2. Data Structures with Java, J.R.Hubbard, 2nd edition, Schaum's Outlines, TMH.
3. Data Structures and algorithms in Java, 2nd Edition, R.Lafore, Pearson Education.
4. Data Structures using Java, D.S.Malik and P.S. Nair, Cengage Learning.
5. Data structures, Algorithms and Applications in java, 2nd Edition, S.Sahani, Universities Press.
6. Design and Analysis of Algorithms, P.H.Dave and H.B.Dave, Pearson education.
7. Data Structures and java collections frame work, W.J.Collins, Mc Graw Hill.
8. Java: the complete reference, 7th Editon, Herbert Schildt, TMH.
9. Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education
10. Java: How to Program P.J.Deitel and H.M.Deitel , 8th dition, HI.
11. Java Programming, D.S.Malik,Cengage Learning.
12. A Practical Guide to Data Structures and Algorithms using Java, S.Goldman & K.Goldman, Chapman & Hall/CRC, Taylor & Francis Group.

(Note: Use packages like `java.io`, `java.util`, etc)

Outcomes:

After completion of this course, the student knows:

- The fundamental design, analysis, and implementation of basic data structures.
- The basic concepts in the specification and analysis of programs.
- The principles for good program design, especially the uses of data abstraction.
- How to write effective program for various data structures
- The basics of various implementation methods
- How to do the performance analysis of different programs

NETWORK PROGRAMMING**Objectives:****The student will know:**

- The foundation of Linux programming basics and to understand the Linux utilities.
- Exploration of file concepts and working with files with API s.
- The process and the role of kernel in process management
- Signal generation and handling with APIs
- IPC with semaphores, shared memory, message queues and multithreading with APIs
- The sockets with client server process communication

UNIT – I

Linux Utilities- File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities and Backup utilities.

Bourne again shell(bash) - Introduction, pipes and redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples.

Review of C programming concepts-arrays, strings (library functions), pointers, function pointers, structures, unions, libraries in C.

UNIT - II

Files- File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions- chmod, fchmod, file ownership-chown, lchown , fchown, links-soft links and hard links – symlink, link, unlink.

File and Directory management – Directory contents, Scanning Directories- Directory file APIs.

Process- Process concept, Kernel support for process, process attributes, process control – process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process.

UNIT - III

Signals- Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions.

Interprocess Communication - Introduction to IPC mechanisms, Pipes- creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Introduction to message queues, semaphores and shared memory.

Message Queues- Kernel support for messages, UNIX system V APIs for messages, client/server example. Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

UNIT – IV

Shared Memory- Kernel support for shared memory, UNIX system V APIs for shared memory, client/server example.

Network IPC - Introduction to Unix Sockets, IPC over a network, Client-Server model ,Address formats(Unix domain and Internet domain), Socket system calls for Connection Oriented - Communication, Socket system calls for Connectionless-Communication, Example-Client/Server Programs- Single Server-Client connection, Multiple simultaneous clients, Socket options – setsockopt, getsockopt, fcntl.

UNIT-V

Network Programming in Java-Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client-Server Application.

TEXT BOOKS:

1. Unix System Programming using C++, T.Chan, PHI.(Units II,III,IV)
2. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.(Unit I)
3. An Introduction to Network Programming with Java, Jan Graba, Springer, rp 2010.(Unit V)
4. Unix Network Programming ,W.R. Stevens, PHI.(Units II,III,IV)
5. Java Network Programming,3rd edition, E.R. Harold, SPD, O'Reilly.(Unit V)

REFERENCE BOOKS:

1. Linux System Programming, Robert Love, O'Reilly, SPD.
2. Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education.
3. UNIX for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson Education.
4. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones, Wrox, Wiley India Edition.
5. Unix Network Programming The Sockets Networking API, Vol.-I,W.R.Stevens, Bill Fenner, A.M.Rudoff, Pearson Education.
6. Unix Internals, U.Vahalia, Pearson Education.
7. Unix shell Programming, S.G.Kochan and P.Wood, 3rd edition, Pearson Education.
8. C Programming Language, Kernighan and Ritchie, PHI

Outcomes:

After completion of this course, the student knows:

- The foundation of Linux programming basics and to understand the Linux utilities.
- Exploration of file concepts and working with files with API s.
- The process and the role of kernel in process management
- Signal generation and handling with APIs
- IPC with semaphores, shared memory, message queues and multithreading with APIs
- The sockets with client server process communication

INFORMATION RETRIEVAL SYSTEMS

Objectives:

The student will know:

- The basic concepts of information retrieval techniques
- Uses of different information retrieval techniques in various application areas
- How to apply IR principles to locate relevant information large collections of data
- The performance analysis of retrieval systems when dealing with unmanaged data sources
- The implementation of retrieval systems for web search tasks.
- The implementation of information retrieval techniques

UNIT I: Boolean retrieval. The term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction, Index compression.

UNIT II: Scoring, term weighting and the vector space model, Computing scores in a complete search system. Evaluation in information retrieval, Relevance feedback and query expansion.

UNIT III: XML retrieval, Probabilistic information retrieval, Language models for information retrieval, Text classification, Vector space classification.

UNIT IV: Support vector machines and machine learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.

UNIT V: Web search basics. Web crawling and indexes, Link analysis.

TEXT BOOK:

1. Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008.

REFERENCE BOOKS:

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer.
2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.
4. Information Retrieval Data Structures and Algorithms, William B Frakes, Ricardo Baeza-Yates, Pearson Education, 1992.
5. Information Storage & Retrieval, Robert Korfhage, John Wiley & Sons.

Outcomes:

After completion of this course, the student knows:

- The basic concepts of information retrieval techniques
- Uses of different information retrieval techniques in various application areas
- How to apply IR principles to locate relevant information large collections of data
- The performance analysis of retrieval systems when dealing with unmanaged data sources
- The implementation of retrieval systems for web search tasks.
- The implementation of information retrieval techniques

INTERNET TECHNOLOGIES AND SERVICES**Objective:****The student will know:**

- The knowledge of programming with java should be able to develop web based solutions using multi-tier architecture.
- Different technologies operated on client and server side components.
- The basics of client side components like HTML5, CSS3, and Javascript etc.
- The Server Side components like Servlets, JSP.
- The Database connectivity using MySQL with Hibernate and Connection Pooling
- The Struts Framework with validation framework, Internationalization

UNIT I**Client Side Technologies:**

Overview of HTML - Common tags, XHTML, capabilities of HTML5 Cascading Style sheets, CSS3 enhancements, linking to HTML Pages, Classes in CSS, Introduction to JavaScripts, variables, arrays, methods and string manipulation, BOM/DOM (Browser/Document Object Model), accessing elements by ID, Objects in JavaScript, Dynamic HTML with JavaScript and with CSS, form validation with JavaScript, Handling Timer Events, Simplifying scripting with JQuery, JASON for Information exchange.

UNIT II**Introduction to Java Servlets:**

Introduction to Servlets: Lifecycle of a Servlet, Reading request and initialization parameters, Writing output to response, MIME types in response, Session Tracking: Using Cookies and Sessions, Steps involved in Deploying an application, Database Access with JDBC and Connection Pooling, Introduction to XML, XML Parsing with DOM and SAX Parsers in Java, Ajax - Ajax programming with JSP/Servlets, creating XML Http Object for various browsers, Sending request, Processing response data and displaying it. Introduction to Hibernate

UNIT III**Introduction to JSP:**

JSP Application Development: Types of JSP Constructs (Directives, Declarations, Expressions, Code Snippets), Generating Dynamic Content, Exception Handling, Implicit JSP Objects, Conditional Processing, Sharing Data Between JSP pages, Sharing Session and Application Data, Using user defined classes with jsp:useBean tag, Accessing a Database from a JSP

UNIT IV**Introduction to Struts Framework:**

Introduction to MVC architecture, Anatomy of a simple struts2 application, struts configuration file, Presentation layer with JSP, JSP bean, html and logic tag libraries, Struts Controller class, Using form data in Actions, Page Forwarding, validation frame work, Internationalization

UNIT V**Service Oriented Architecture and Web Services**

Overview of Service Oriented Architecture – SOA concepts, Key Service Characteristics, Technical Benefits of a SOA, Introduction to Web Services– The definition of web services, basic operational model of web services, basic steps of implementing web services. Core fundamentals of SOAP – SOAP Message Structure, SOAP encoding, SOAP message exchange models, Describing Web Services –Web Services life cycle, anatomy of WSDL, Introduction to Axis– Installing axis web service framework, deploying a java web service on axis. Web Services Interoperability – Creating java and .Net client applications for an Axis Web Service (Note: The Reference Platform for the course will be open source products Apache Tomcat Application Server, MySQL database, Hibernate and Axis)

TEXT BOOKS:

1. Web Programming, building internet applications, Chris Bates 3rd edition, WILEY Dreamtech .
2. The complete Reference Java 7th Edition , Herbert Schildt., TMH.
3. Java Server Pages,Hans Bergsten, SPD, O'Reilly.
4. Professional Jakarta Struts - James Goodwill, Richard Hightower, Wrox Publishers.
5. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India, rp – 2008.
6. Understanding SOA with Web Services, Eric Newcomer and Greg Lomow, Pearson Edition – 2009
7. Java Web Service Architecture, James McGovern, Sameer Tyagi et al., Elsevier - 2009

REFERENCE BOOKS:

1. Programming the world wide web,4th edition,R.W.Sebesta,Pearson
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES , Marty Hall and Larry Brown Pearson
3. Internet and World Wide Web – How to program , Dietel and Nieto PHI/Pearson.
4. Jakarta Struts Cookbook , Bill Siggelkow, S P D O'Reilly.
5. Professional Java Server Programming,S.Allamaraju & othersApress(dreamtech).
6. Java Server Programming ,Ivan Bayross and others,The X Team,SPD
7. Web Warrior Guide to Web Programmng-Bai/Ekedaw-Cengage Learning.
8. Beginning Web Programming-Jon Duckett ,WROX.

Outcomes:

After completion of this course, the student knows:

- The knowledge of programming with java should be able to develop web based solutions using multi-tier architecture.
- Different technologies operated on client and server side components.
- The basics of client side components like HTML5, CSS3, and Javascript etc.
- The Server Side components like Servlets, JSP.
- The Database connectivity using MySQL with Hibernate and Connection Pooling

**DATA MINING
(CORE ELECTIVE-III)****Objective:****The student will know:**

- The concepts and functionalities of data mining
- How to develop the abilities of critical analysis to data mining systems and applications.
- Implement practical and theoretical understanding of the technologies for data mining
- The strengths and limitations of various data mining models
- Exploration of web and text mining
- The basics of temporal and spatial mining

UNIT-I:**Data mining Overview and Advanced Pattern Mining**

Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis, outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

UNIT-II:**Advance Classification**

Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods – genetic algorithms, roughset approach, fuzzy set approach

UNIT-III:**Advance Clustering**

Density - based methods – DBSCAN, OPTICS, DENCLUE; Grid-Based methods – STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional Data; Clustering Graph and Network Data.

UNIT-IV:**Web and Text Mining**

Introduction, web mining, web content mining, web structure mining, web usage mining, Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

UNIT-V:**Temporal and Spatial Data Mining**

Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

TEXT BOOKS:

1. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann.
2. Data Mining Techniques – Arun K Pujari, Universities Press.

REFERENCE BOOKS:

1. Introduction to Data Mining – Pang-Ning Tan, Vipin Kumar, Michael Steinbach, Pearson
2. Data Mining Principles & Applications – T.V Suresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.

Outcomes:

After completion of this course, the student knows:

- The concepts and functionalities of data mining
- How to develop the abilities of critical analysis to data mining systems and applications.
- Implement practical and theoretical understanding of the technologies for data mining
- The strengths and limitations of various data mining models
- Exploration of web and text mining
- The basics of temporal and spatial mining

**STORAGE AREA NETWORKS
(CORE ELECTIVE-III)**

Objectives:**The student will know:**

- The Storage Area Networks characteristics and components.
- The SAN vendors and their products familiarity
- Fiber Channel protocols for communication between SAN components.
- Cisco MDS 9000 Multilayer Directors and Fabric Switches
- Cisco SAN-OS features.
- The uses of all SAN-OS commands

UNIT I:

Introduction to Storage Technology: Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

UNIT II:

Storage Systems Architecture: Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components , Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,High-level architecture and working of an intelligent storage system

UNIT III:

Introduction to Networked Storage: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS fulfills the need, understand the appropriateness of the different networked storage options for different application environments

UNIT IV:

Information Availability & Monitoring & Managing Datacenter: List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime, Differentiate between business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures , Architecture of backup/recovery and the different backup/recovery topologies , replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities, Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

UNIT V:

Securing Storage and Storage Virtualization: Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

Case Studies: The technologies described in the course are reinforced with EMC examples of actual solutions. Realistic case studies enable the participant to design the most appropriate solution for given sets of criteria.

TEXT BOOK:

1. EMC Corporation, Information Storage and Management, Wiley.

REFERENCE BOOKS:

1. Robert Spalding, “Storage Networks: The Complete Reference“, Tata McGraw Hill, Osborne, 2003.
2. Marc Farley, “Building Storage Networks”, Tata McGraw Hill ,Osborne, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

Outcomes:

After completion of this course, the student knows:

- The Storage Area Networks characteristics and components.
- The SAN vendors and their products familiarity
- Fiber Channel protocols for communication between SAN components.
- Cisco MDS 9000 Multilayer Directors and Fabric Switches
- Cisco SAN-OS features.
- The uses of all SAN-OS commands

**SEMANTIC WEB AND SOCIAL NETWORKS
(CORE ELECTIVE –III)**

Objectives:**The student will know:**

- The fundamentals of social networks
- Web Intelligence
- Knowledge Representation for the Semantic Web
- Ontology Engineering
- Semantic Web Applications, Services and Technology
- Social Network Analysis and semantic web

UNIT –I: Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today’s Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT -II: Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.

UNIT-III: Ontology Engineering: Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-IV: Semantic Web Applications, Services and Technology: Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods,

UNIT-V: Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer
4. Publications.
5. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O’Reilly, SPD.

Outcomes:**After completion of this course, the student knows:**

- The fundamentals of social networks
- Web Intelligence
- Knowledge Representation for the Semantic Web
- Ontology Engineering
- Semantic Web Applications, Services and Technology
- Social Network Analysis and semantic web

**CYBER SECURITY
(CORE ELECTIVE-III)****Objectives:****The student will know:**

- About cyber crimes and how they are planned
- The vulnerabilities of mobile and wireless devices
- About the crimes in mobile and wireless devices
- Various legal perspectives in cyber security
- The basics of computer forensics
- The organizational cyber security implications

UNIT-I

Introduction to Cybercrime: Introduction, Cybercrime and Information security, who are cybercriminals, Classifications of Cybercrimes, Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber offenses: How criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT-II

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT III

Cybercrimes and Cyber security: the Legal Perspectives: Introduction: Cyber Crime and Legal Landscape around the world, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario In India, Digital signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment. Cyber law, Technology and Students: Indian Scenario.

UNIT IV**Understanding Computer Forensics**

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Chain of Custody concept, Network Forensics, Approaching a computer, Forensics Investigation, Challenges in Computer Forensics, Special Tools and Techniques. Forensics Auditing

UNIT V**Cyber Security: Organizational Implications**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group

REFERENCE BOOK:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

Outcomes:

After completion of this course, the student knows:

- About cyber crimes and how they are planned
- The vulnerabilities of mobile and wireless devices
- About the crimes in mobile and wireless devices
- Various legal perspectives in cyber security
- The basics of computer forensics
- The organizational cyber security implications

**BIG DATA ANALYTICS
(CORE ELECTIVE –IV)****Objectives:****The student will know:**

- About big data
- Analysis of Big Data
- The fundamentals of Map Reduce methods
- The data technologies like hadoop
- The basics of data science
- Social media analytics

Unit I

Big Data Analytics : What is big data, History of Data Management ; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data;

Big Data Analytics: What is Big Data Analytics, What Big Data Analytics Isn't, Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools;

Unit- II

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

Unit III

Understanding MapReduce Fundamentals and HBase : The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop : Introduction of HDFS, Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability; Introducing HBase, Architecture, Storing Big Data with HBase , Interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS

Unit IV

Big Data Technology Landscape and Hadoop : NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors; HDFS (Hadoop Distributed File System), HDFS Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

Unit V

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools;

TEXT BOOKS

1. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black BookTM , DreamTech Press, 2015 Edition.
3. BUSINESS ANALYTICS 5e , Albright Winston

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra- Fernandez,” Business Intelligence –Practice, Technologies and Management”, John Wiley 2011.
2. Lariss T. Moss,ShakuAtre, “ Business Intelligence Roadmap”, Addison-Wesley It Service.
3. Yuli Vasiliev, “ Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

Outcomes:

After completion of this course, the student knows:

- About big data
- Analysis of Big Data
- The fundamentals of Map Reduce methods
- The data technologies like hadoop
- The basics of data science
- Social media analytics

SOFT COMPUTING
(CORE ELECTIVE –IV)**Objectives:****The student will know:**

- The knowledge of soft computing theories fundamentals
- The fundamentals of artificial and neural network
- AI problems with their solutions
- The various classical sets and their properties
- The fuzzy sets, fuzzy logic and genetic algorithms
- The implementation details of fuzzy logic control systems

UNIT-I

AI Problems and Search: AI problems, Techniques, Problem Spaces and Search, Heuristic Search Techniques- Generate and Test, Hill Climbing, Best First Search Problem reduction, Constraint Satisfaction and Means End Analysis. Approaches to Knowledge Representation- Using Predicate Logic and Rules.

UNIT-II

Artificial Neural Networks: Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back propagation Network. Associative Memory Networks. Traing Algorithms for pattern association, BAM and Hopfield Networks.

UNIT-III

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT-IV

Introduction to Classical Sets (crisp Sets)and Fuzzy Sets- operations and Fuzzy sets. Classical Relations -and Fuzzy Relations- Cardinality, Operations, Properties and composition. Tolerance and equivalence relations. Membership functions- Features, Fuzzification, membership value assignments, Defuzzification.

UNIT-V

Fuzzy Arithmetic and Fuzzy Measures, Fuzzy Rule Base and Approximate Reasoning Fuzzy Decision making, Fuzzy Logic Control Systems, Genetic Algorithm- Introduction and basic operators and terminology. Applications: Optimization of TSP, Internet Search Technique.

TEXT BOOKS:

1. Principles of Soft Computing- S N Sivanandam, S N Deepa, Wiley India, 2007
2. Soft Computing and Intelligent System Design -Fakhreddine O Karray, Clarence D Silva,. Pearson Edition, 2004.

REFERENCE BOOKS:

1. Artificial Intelligence and SoftComputing- Behavioural and Cognitive Modeling of the Human Brain - Amit Konar, CRC press, Taylor and Francis Group.
2. Artificial Intelligence – Elaine Rich and Kevin Knight, TMH, 1991, rp2008.
3. Artificial Intelligence – Patric Henry Winston – Third Edition, Pearson Education.
4. A first course in Fuzzy Logic-Hung T Nguyen and Elbert A Walker, CRC. Press Taylor and Francis Group.

Outcomes:

After completion of this course, the student knows:

- The knowledge of soft computing theories fundamentals
- The fundamentals of artificial and neural network
- AI problems with their solutions
- The various classical sets and their properties
- The fuzzy sets, fuzzy logic and genetic algorithms
- The implementation details of fuzzy logic control systems

**SOFTWARE PROCESS AND PROJECT MANAGEMENT
(CORE ELECTIVE – IV)****Objectives:****The student will know:**

- The basics of software process maturity
- The uses of workflows and checkpoints in the process planning
- The purpose and importance of project management
- The perspectives of planning, tracking and completion of project
- Comparison of organization structures and project structures
- The Implementation of a project using suitable project management tools

UNIT I

Software Process Maturity : Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process.

Process Reference Models : Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP.

UNIT II

Software Project Management Renaissance : Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts : Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model based software architectures.

UNIT III

Workflows and Checkpoints of process : Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments.

Process Planning: Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT IV

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation : The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

UNIT V

CCPDS-R Case Study and Future Software Project Management Practices : Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, *Watts S. Humphrey*, Pearson Education.
2. Software Project Management, *Walker Royce*, Pearson Education.

REFERENCE BOOKS:

1. Effective Project Management: Traditional, Agile, Extreme, Robert Wysocki, Sixth edition, Wiley India, rp2011.
2. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
3. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
6. Software Engineering Project Managent, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
7. The Art of Project Management, Scott Berkun, SPD, O'Reilly, 2011.
8. Applied Software Project Management, Andrew Stellman & Jennifer Greene, SPD, O'Reilly, rp2011.
9. Agile Project Management, Jim Highsmith, Pearson education, 2004.

Outcomes:

After completion of this course, the student knows:

- The basics of software process maturity
- The uses of workflows and checkpoints in the process planning
- The purpose and importance of project management
- The perspectives of planning, tracking and completion of project
- Comparison of organization structures and project structures
- The Implementation of a project using suitable project management tools

**DISTRIBUTED COMPUTING
(CORE ELECTIVE-IV)**

Objectives:**The student will know:**

- The basics of different forms of computing
- The foundation of cooperative distributed systems engineering
- To learn the Supporting technologies with a special attention to agent-oriented paradigm
- About Service-oriented computing and grid computing
- The implementation component includes a term-project
- The awareness of globus GT3 Toolkit

UNIT I:

Introduction: The different forms of computing, The strengths and weaknesses of Distributed computing, Operating system concepts relevant to distributed computing, the architecture of distributed applications. Paradigms for Distributed Applications, choosing a Paradigm for an application (trade-offs).

UNIT II:

Cluster Computing: Parallel computing overview, cluster computing – Introduction, Cluster Architecture, parallel programming models and Paradigms, Applications of Clusters.

UNIT III:

Grid Computing: Introduction, Grid Computing Anatomy – Architecture, Architecture and relationship to other Distributed Technologies, Grid computing road map. Merging the Grid services Architecture with the Web Services Architecture

UNIT IV:

Open Grid Service Architecture: Introduction, Architecture and Goal, Sample Use cases: Commercial Data Center, National Fusion Collaboratory, Online Media and Entertainment. OGSA platform Components, Open Grid Services Infrastructure.

UNIT V:

Globus GT 3 Toolkit: Architecture, Programming Model, A sample implementation, High Level services, OGSI.NET Middleware Solutions.

TEXT BOOKS:

1. Grid Computing, Joshy Joseph & Craig Fellenstein, Pearson education, 2004
2. Distributed Computing, Principles and Applications, M.L.Liu, Pearson Education, 2004
3. High Performance Cluster Computing, Rajkumar Buyya, Pearson education.

REFERENCE BOOKS:

1. Grid Computing – Making the global infrastructure a reality, Fran Berman, Geoffrey C Fox, Anthony J G Hey, Wiley India, 2010.
2. A Networking Approach to Grid Computing, D.Minoli, Wiley & sons, 2006.
3. Grid Computing: A Practical Guide to Technology and Applications, A.Abbas, Firewall Media, 2008.

Outcomes:

After completion of this course, the student knows:

- The basics of different forms of computing
- The foundation of cooperative distributed systems engineering
- To learn the Supporting technologies with a special attention to agent-oriented paradigm
- About Service-oriented computing and grid computing
- The implementation component includes a term-project
- The awareness of globus GT3 Toolkit

MOBILE COMPUTING
(Open Elective-II)

Objectives:

The student will know:

- The mobile computing architecture
- The basics of mobile technologies like GSM, SMS, GPRS etc.
- The working principle of mobile networks
- The basics of mobile network protocols like VOIP, SIP etc.
- J2ME architecture for wireless device communication
- Design and development of mobile applications

UNIT-I

Introduction, Mobile Computing Architecture, Mobile Computing through Telephony, Emerging Technologies

UNIT-II

Global System for Mobile Communications (GSM), Short Message Service (SMS), General Packet Radio Services (GPRS), Wireless Application Protocol (WAP), CDMA and 3G.

UNIT-III

Wireless LAN, Intelligent Network and Internetworking, Client Programming, Programming for PalmOS, Wireless Devices with Symbian OS.

UNIT-IV

J2ME Introduction, J2ME Architecture, MIDLET, MidLet Suite , J2ME Profiles, Wireless Devices with WindowsCE, Voice Over Internet Protocol and Convergence, Session Internet Protocol(SIP),other protocols.

UNIT-V

Multimedia, IP Multimedia Subsystems, Security Issues in Mobile Computing, Next Generation Networks.

TEXTBOOKS:

1. Mobile Computing Technology, Applications and Service Creation by Ashok Talukder , Hasan Ahmed, Roopa R Yavagal.
2. Mobile Computing Principles by Raza B'Far, Cambridge.
3. Mobile Computing by Raj Kamal 2e.
4. Mobile Computing by Jochen schiller.

Outcomes:

After completion of this course, the student knows:

- The mobile computing architecture
- The basics of mobile technologies like GSM, SMS, GPRS etc.
- The working principle of mobile networks
- The basics of mobile network protocols like VOIP, SIP etc.
- J2ME architecture for wireless device communication
- Design and development of mobile applications

SOCIAL MEDIA INTELLIGENCE
(Open Elective-II)

Objectives:**The student will know:**

- The basics of social media intelligence
- The fundamentals of opinion formation
- About opinion ecosystems
- How to manage social media communities for better social media intelligence
- Marketing research methods
- How to build a social media intelligence in to our strategies

UNIT – I

The Beginnings of Social Media Intelligence: What is Social Media monitoring? Anecdotal referencing of Social Media Comments, Text Mining, Some Simple Metrics, Using Social Media as Early Warning System.

Fundamental of Opinion Formation: Affecting Opinion versus Biasing Expression, How Do We Form Opinions?, How Do Expectations Affect Opinion?, How Do Expertise and Knowledge Influence How We Form Opinions?, Opinion Formation in a Social Context, Bandwagon behavior and Information Cascades, Implications for Social Media Intelligence.

UNIT – II

Why Do We Share our Opinions: Poster versus Lurkers, What Motivates Us to Post/, Posting Motivations and Selection effects, Implications for Social Media Intelligence.

The Social effects of Strangers : How Does Social Context Affect Our Behavior?, How Influential is the Social Context/, How Does Social Context Affect Opinion Expression/, Bandwagon Behavior in Opinion expression, Differentiating Our opinions, Multiple Audience Effects, /can We Trust the Wisdom of Crowds.

UNIT – III

Opinion Ecosystems and the Evolution Within : Life Cycle Dynamics, Preference Mismatching and Sequential Dynamics, Social Dynamics, Are Social Media Communities the Cause of Opinion Radicalization ?, Online Echo Chambers, Implications for Social **Media Monitoring and Metrics. Are Social Media Fragmenting the Population ? :** Self-Organization, Birds of a Feather Flock Together, Geography No Longer Defines Our Communities, The influential Hypothesis, The New Influential, How Can We Identify Influentials, Influence in e-Commerce, Some Concluding Remarks.

UNIT – IV

Managing Social Media Communities for Better Social Media Intelligence: Creating an Inviting Environment, The Benefits of a Well-Managed Opinion Community (and the Costs of Not Managing the Community at All) Quality of Intelligence Depends on the Quality of the Opinion Community, Creating and Manipulating Buzz, Buzz Campaign or Fraud?, Identifying Fraudulent Opinions

Cutting Through the Online Chatter : A New Paradigm for Marketing Research, Measure What Matters, Cast a Wide Net, Analyze the Text, Understand the biases, Establish Links to Performance metrics.

UNIT – V

Intelligence Integration : Overview of Marketing Research Methods, Using Social Media for Marketing research, Tracking Brand Health, Understanding Market Structure, Social Shopping, Integration with Data from Other Parts of the Organization, Intelligence Dashboards.

Building Social Media Intelligence into Our Strategies : How Can Social Media Intelligence Help Integrate an Organization's Strategy?, Multichannel Strategies, Rapid Response System, Integrated CRM, Leveraging Social Data, Seeding Strategies. Moving from Social Media monitoring to Social Media Intelligence : Social Media Intelligence today, Social Media Intelligence tomorrow, Building on the Science of Opinion, tapping into Opinion Ecosystems, Developing an Integrated Strategy.

TEXT BOOK:

1. SOCIAL MEDIA INTELLIGENCE - Wendy W.Moe, David A. Schweidel, Cambridge University, edition 2014.

Outcomes:

After completion of this course, the student knows:

- The basics of social media intelligence
- The fundamentals of opinion formation
- About opinion ecosystems
- How to manage social media communities for better social media intelligence
- Marketing research methods
- How to build a social media intelligence in to our strategies

**WEB USABILITY
(Open Elective-II)**

Objectives:

The student will know:

- About usability and human factors.
- The details of user-centered design
- How to understand and access users goals
- Heuristic evaluation method
- Tools and techniques used for effective web utilization
- How to perform usability testing on various webs.

UNIT I

Introduction to Usability, Human Factors,

UNIT II

User-Centered Design, Usability Aware Design,

UNIT III

Accessibility, Understanding your Users and Goals,

UNIT IV

Heuristic Evaluation, Usability Testing,

UNIT V

Other Tools and Techniques, Transferring Data into Change

TEXT BOOK:

1. Web Usability Hand Book by Mark Pearrow, Thomson Delmar learning

Outcomes:

After completion of this course, the student knows:

- About usability and human factors.
- The details of user-centered design
- How to understand and access users goals
- Heuristic evaluation method
- Tools and techniques used for effective web utilization
- How to perform usability testing on various webs.

INTERNET TECHNOLOGIES AND SERVICES LAB

Objectives:

The student will know:

- How to write syntactically correct HTTP messages and describe the semantics of common HTTP methods and header fields
- Differences between URIs, URNs, and URLs, and demonstrate a detailed understanding of http-scheme URLs, both relative and absolute
- The actions, including those related to the cache, performed by a browser in the process of visiting a Web address
- The Installation of a web server and perform basic administrative procedures, such as tuning communication parameters, denying access to certain domains, and interpreting an access log
- How to write a valid standards-conformant HTML document involving a variety of element types, including hyperlinks, images, lists, tables, and forms
- Uses of CSS to implement a variety of presentation effects in HTML and XML documents, including explicit positioning of elements

List of Sample Problems:

i) Internet Technologies

1. Develop static pages (using Only HTML) of an online Book store. The pages should resemble: *www.amazon.com* the website should consist the following pages.
Home page, Registration and user Login User Profile Page, Books catalog Shopping Cart, Payment By credit card Order Conformation
2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
3. 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.
4. Install TOMCAT web server. Convert the static web pages of assignments 2 into dynamic web pages using Servlets 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.
5. Redo the previous task using JSP by converting the static web pages of assignments 2 into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. Follow the MVC architecture while doing the website.
6. Implement the "Hello World!" program using JSP Struts Framework.

ii) Additional Assignment Problems

1. Write an HTML page including any required Javascript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box.
2. Write a java swing application that takes a text file name as input and counts the characters, words and lines in the file. Words are separated with white space characters and lines are separated with new line character.
3. Write a simple calculator servlet that takes two numbers and an operator (+, -, /, * and %) from an HTML page and returns the result page with the operation performed on the operands. It should check in a database if the same expression is already computed and if so, just return the value from database. Use MySQL or PostgreSQL.
4. Write an HTML page that contains a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).

- Write a servlet that takes name and age from an HTML page. If the age is less than 18, it should send a page with "Hello <name>, you are not authorized to visit this site" message, where <name> should be replaced with the entered name. Otherwise it should send "Welcome <name> to this site" message.
- Write a calculator program in HTML that performs basic arithmetic operations (+, -, /, * and %). Use CSS to change the foreground and background color of the values, buttons and result display area separately. Validate the input strings using JavaScript regular expressions. Handle any special cases like division with zero reasonably. The screen may look similar to the following:

- Write a Java program that creates a calculator GUI, as shown in figure. Extra components may be added for convenience: Scheme may be Black on White or Blue on Yellow (selectable) and accordingly all components colors must be changed. The values can be either entered or increased or decreased by a step of 10. The operators are +, -, / and * (selectable). Once any change takes place, the result must be automatically computed by the program.

- Write a Java Application that will read an XML file that contains personal information (Name, Mobile Number, age and place). It reads the information using SAX parser. After reading the information, it shows two input Text Fields in a window, one for tag name and the other for value. Once these two values are given, it should list all the records in the XML file that match the value of the given field in a text area (result box). For example, if the two text boxes are entered with "name" and "ABCD" then it should show all the records for which name is "ABCD"? An Illustration is given below that takes a mobile number and lists all the records that have the same mobile number.

- Consider the following web application for implementation: The user is first served a login page which takes user's name and password. After submitting the details the server checks these values against the data from a database and takes the following decisions. If name and password matches, serves a welcome page with user's full name. If name matches and password doesn't match, then serves "password mismatch" page. If name is not found in the database, serves a registration page, where users full name, present user name (used to login) and password are collected. Implement this application in:
 - Pure JSP
 - Pure Servlets
 - Struts Framework

10. Implement a simple arithmetic calculator with +, -, /, *, % and = operations using Struts Framework. The number of times the calculator is used should be displayed at the bottom (use session variable).

iii) Internet Technologies and Services Lab - Additional Problems

1. Create a web Service in Java that takes two city names from the user and returns the distance between these two from data available from a table in MySQL. Write a java and a C# client which use your created web service.
2. Write a Java program that takes a file as input and encrypts it using DES encryption. The program should check if the file exists and its size is not zero.
3. Write a Java program that generates a key pair and encrypts a given file using RSA algorithm.
4. Write a Java program that finds digest value of a given string.
5. Consider the following xml file for encryption

```
<?xml version="1.0"> <transaction> <from>12345</from> <to>54321</to> <amount>10000</amount>
<secretcode>abc123</secretcode> <checksum></checksum> </transaction>
```

Replace <from> and <to> values with the RSA encrypted values represented with base64 encoding assuming that the public key is available in a file in local directory "pubkey.dat". Encrypt <secretcode> with AES algorithm with a password 'secret'. The checksum of all the field values concatenated with a delimiter character '+' will be inserted in the checksum and the xml file is written to encrypted.xml file.
6. Assume that a file 'config.xml', which has the following information:

```
<users>
<user> <name>abc</name> <pwd>pwd123</pwd> <role>admin</role> <md5>xxx</md5> </user>
<user> <name>def</name> <pwd>pwd123</pwd> <role>guest</role> <md5>xxx</md5> </user>
</users>
```

Replace name and role with DES encrypted values and pwd with RSA encrypted values (represent the values with base64 encoding). The public key is available in "public.key" file in current directory. Replace xxx with respective MD5 values of all the fields for each user. Write the resulting file back to config.xml.
7. Write an HTML page that gives 3 multiple choice (a,b,c and d) questions from a set of 5 preloaded questions randomly. After each question is answered change the color of the question to either green or blue using CSS. Finally on clicking OK button that is provided, the score should be displayed as a pop-up window. Use Java Script for dynamic content.
8. Write an HTML page that has 3 countries on the left side ("USA", "UK" and "INDIA") and on the right side of each country, there is a pull-down menu that contains the following entries: ("Select Answer", "New Delhi", "Washington" and "London"). The user will match the Countries with their respective capitals by selecting an item from the menu. The user chooses all the three answers (whether right or wrong). Then colors of the countries should be changed either to green or to red depending on the answer. Use CSS for changing color.
9. Write an HTML Page that can be used for registering the candidates for an entrance test. The fields are: name, age, qualifying examination (diploma or 10+2), stream in qualifying examination. If qualifying examination is "diploma", the stream can be "Electrical", "Mechanical" or "Civil". If the qualifying examination is 10+2, the stream can be "MPC" or "BPC". Validate the name to accept only characters and spaces.
10. Write an HTML page that has two selection menus. The first menu contains the states ("AP", "TN" and "KN") and depending on the selection the second menu should show the following items: "Hyderabad", "Vijayawada", "Kurnool" for AP, "Chennai", "Salem", "Madurai" for TN and "Bangalore", "Bellary", "Mysore" for KN.

-
11. Write an HTML page that has phone buttons 0 to 9 and a text box that shows the dialed number. If 00 is pressed at the beginning, it should be replaced with a + symbol in the text box. If the number is not a valid international number (+ followed by country code and 10 digit phone number) the color of the display should be red and it should turn to green when the number is valid. Consider only "+91, +1 and +44 as valid country codes. Use CSS for defining colors.
 12. Write an HTML page that has a text box for phone number or Name. If a number is entered in the box the nameshould be displayed next to the number. If 00 is pressed at the beginning, it should be replaced with a + symbol in the text box. If a name is entered in the text box, it should show the number next to the name. If the corresponding value is not found, show it in red and show it in green otherwise. Use CSS for colors. Store at least 5 names and numbers in the script for testing.
 13. A library consists of 10 titles and each title has a given number of books initially. A student can take or return a book by entering his/her HTNo as user ID and a given password. If there are at least two books, the book is issued and the balance is modified accordingly.
 - (a) Use RDBMS and implement it with JSP.
 - (b) Use XML File for data and Implement it with JSP
 - (c) Use RDBMS and implement it with Servlets
 - (d) Use XML File for data and Implement it with Servlets
 14. A Bus Reservation System contains the details of a bus seat plan for 40 seats in 2x2 per row arrangement, where the seats are numbered from 1 to 40 from first row to last row. The customer can visit the website and can reserve a ticket of his choice if available by entering his details (Name, Address, Gender and Age). The customer can cancel the ticket by entering the seat number and his name as entered for reservation.
 - (a) Use RDBMS and implement it with JSP.
 - b) Use XML File for data and Implement it with JSP
 - (c) Use RDBMS and implement it with Servlets
 - (d) Use XML File for data and Implement it with Servlets.
 15. Implement a simple messaging system with the following details: When a student logs in with his/her HTNO and a given password, they should get all the messages posted to him/her giving the ID of sender and the actual message. Each message may be separated with a ruler. There should be a provision for the user to send a message to any number of users by giving the IDs separated with commas in the "To" text box.
 - (a) Use RDBMS and implement it with JSP.
 - (b) Use XML File for data and Implement it with JSP
 - (c) Use RDBMS and implement it with Servlets
 - (d) Use XML File for data and Implement it with Servlets.
 15. There is an image of 600x100 size which can be logically divided into 12 button areas with labels (0-9, +, =). Write a javascript calculator program that uses this image as input virtual keyboard and three text areas for two input numbers and result of sum of these numbers. Add a CSS that can be used to change the colors of text and background of text areas and the page. The input numbers can be up to 4 digits each.
 16. Develop a web application that takes user name and password as input and compares them with those available in an xml user database. If they match, it should display the welcome page that contains the user's full name and last used date and time retrieved from a client cookie. On logout it stores new time to the cookie and displays a goodbye page. If authentication fails, it should store the attempt number to the client cookie and displays an error page. Add necessary CSS that takes care of the font, color of foreground and background.
 17. A web application has the following specifications:

The first page (Login page) should have a login screen where the user gives the login name and password. Both fields must be validated on client side for a minimum length of 4 characters, name should be lower case a- z characters only and password should contain at least one digit. On submitting these values, the server should validate them with a MySQL database and if failed, show the login page along with a message saying

“Login Name or Password Mismatch” in Red color below the main heading and above the form. If successful, show a welcome page with the user's full name (taken from database) and a link to Logout. On logout, a good bye page is displayed with the total time of usage (Logout time – login time). Specify the Schema details of table and web.xml file contents. Implement it using (a) JSP Pages (b) Servlets (c) Struts

18. Design a struts based web portal for an international conference with following specifications:

The welcome page should give the details of the conference and a link to login. If login fails, direct them back for re-login and also provide a link for registration. On successful registration/login, the user will be directed to a page where s/he can see the status (accepted/rejected) of their already submitted papers followed by a form for submitting a doc file to the conference. Provide a logout button on all pages including the home page, once the user logs in. Implement validation framework to check that the user name is in the form of CCDDCC and password is in the form of (CCSDDD) (C for character, S for special character (one of @, #, \$, %, ^, & and !), and D for digit)., Database should be accessed through Connection Pool for MySQL for user information. Provide scope for internationalization in future. Assume any missing information and mention it first.

Outcomes:

After completion of this course, the student knows:

- How to write syntactically correct HTTP messages and describe the semantics of common HTTP methods and header fields
- Differences between URIs, URNs, and URLs, and demonstrate a detailed understanding of http-scheme URLs, both relative and absolute
- The actions, including those related to the cache, performed by a browser in the process of visiting a Web address
- The Installation of a web server and perform basic administrative procedures, such as tuning communication parameters, denying access to certain domains, and interpreting an access log
- How to write a valid standards-conformant HTML document involving a variety of element types, including hyperlinks, images, lists, tables, and forms
- Uses of CSS to implement a variety of presentation effects in HTML and XML documents, including explicit positioning of elements