# UNIVERSITY VISION AND MISSION

## VISION

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

## MISSION

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

# VISION AND MISSION OF THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## VISION

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

## MISSION

- Equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- Create an ambience of education through faculty training, self learning, sound academic practices and research endeavors.
- Facilitate a research culture in the department leading to high quality publications and funded projects.
- To identify potential areas of research and create centre of excellence in those areas.
- Provide opportunities to promote organizational and leadership skills in students through various extra – curricular activities.
- Expose the students to emerging and upcoming technologies through co-curricular events.
- To make the students as for as possible industry ready to enhance their employability in the industries.
- To improve department industry collaboration through internship programme and interaction with professional society through seminar/workshops.
- Imbibe social awareness and responsibility in students to serve the society.

# PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
# M.Tech. (Software Engineering)

## PROGRAMME EDUCATIONAL OBJECTIVES

- To impart advanced concepts of software engineering design and development.
- To train the graduates in process methodologies and techniques for software development.
- To provide in depth knowledge on the application of software engineering CASE tools and their relevance to industry practices.
- To pursue research in software modeling and design for solving complex problems.

## PROGRAMME OUTCOMES

On completion of the programme the graduates will

- have the knowledge and skills in the processes and practices adopted in software development.
- be able to apply software engineering tools for solving real life problems.
- be able to undertake need based research focus on issues related to industries.
- be equipped with necessary skills for technical documentation and presentation.

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

# REGULATIONS 2013
# FOR
# M.TECH. DEGREE PROGRAMMES
## (WITH AMENDMENTS INCORPORATED TILL JUNE 2015)

# B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI 48.
## *REGULATIONS -2013 FOR M.TECH / MCA / M.Sc. DEGREE PROGRAMMES*

***(With amendments incorporated till June 2015)***

## 1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i) **"Programme"** means Post Graduate Degree Programme (M.Tech./ MCA / M.Sc.)

ii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.

iii) **"University"** means B.S.Abdur Rahman University, Chennai, 600048.

iv) **"Institution"** unless otherwise specifically mentioned as an autonomous or off campus institution means B.S.Abdur Rahman University.

v) **"Academic Council"** means the Academic Council of this University.

vi) **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S.Abdur Rahman University.

vii) **"Dean (Student Affairs)"** means Dean(Student Affairs) of B.S.Abdur Rahman University.

viii) **"Controller of Examinations"** means the Controller of Examinations of B.S.Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

## 2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

### 2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

| Degree | Mode of Study |
|---|---|
| M.Tech. | Full Time |
| M.Tech. | Part Time – Day / Evening |
| M.C.A. | Full Time |
| M. Sc. | Full Time |
| M. Sc. | Full Time |

## 2.2 MODES OF STUDY

### 2.2.1 Full-time

Students admitted under "Full-Time" shall be available in the Institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

**2.2.2** A full time student, who has completed all non-project courses desiring to do the Projectwork in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department, if the student satisfies the clause 2.3.4 of this Regulation. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

### 2.2.3 Part time - Day time

In this mode of study, the students are required to attend classes for the courses registered along with full time students.

### 2.2.4 Part time - Evening

In this mode of study, the students are required to attend normally classes in the evening and on Saturdays, if necessary.

**2.2.5** A part time student is not permitted to convert to full time mode of study.

## 2.3 ADMISSION REQUIREMENTS

**2.3.1** Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this University as specified in the Table shown for eligible entry qualifications for admission to P.G. programmes or any other degree examination of any University or authority accepted by this University as equivalent thereto.

**2.3.2** Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by this Institution from time to time.

**2.3.3** All part-time students should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by this Institution from time to time.

**2.3.4** A student eligible for admission to M.Tech. Part Time / Day Time programme shall have his/her permanent place of work within a distance of 65km from the campus of this Institution.

**2.3.5** Student eligible for admission to M.C.A under lateral entry scheme shall be required to have passed three year degree in B.Sc (Computer Science) / B.C.A / B.Sc (Information Technology)

## 3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

**3.1** The minimum and maximum period for completion of the P.G. Programmes are given below:

| Programme | Min.No.of Semesters | Max.No.of Semesters |
|---|---|---|
| M.Tech. (Full Time) | 4 | 8 |
| M.Tech.(Part Time) | 6 | 12 |
| M.C.A. (Full Time) | 6 | 12 |
| M.C.A. (Full Time) – (Lateral Entry) | 4 | 8 |
| M.Sc. (Full Time) | 4 | 8 |

3.2 The PG. programmes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. Elective courses
iii. Project work / thesis / dissertation
iv. Laboratory Courses
v. Case studies
vi. Seminars
vii. Industrial Internship

**3.3** The curriculum and syllabi of all PG. programmes shall be approved by the Academic Council of this University.

**3.4** The minimum number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.

**3.5** Each academic semester shall normally comprise of 80 working days. Semester-end examinations will follow immediately after the last working day.

## ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

| Sl. No. | Name of the Department | P.G. Programmes offered | Qualifications for admission |
|---|---|---|---|
| 01. | Civil Engineering | M.Tech. (Structural Engineering) | B.E / B.Tech. (Civil Engineering) / (Structural Engineering) |
| | | M.Tech. (Construction Engineering and Project Management) | |
| 02. | Mechanical Engineering | M.Tech. (Manufacturing Engineering) | B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Marine Engineering) |
| | | M.Tech. CAD / CAM | |
| 03. | Polymer Engineering | M.Tech. (Polymer Technology) | B.E./ B.Tech. degree Mech./Production/ Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry) |
| 04. | Electrical and Electronics Engineering | M.Tech. (Power Systems Engg) | B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation) |
| | | M.Tech. (Power Electronics & Drives) | |
| 05. | Electronics and Communication Engineering | M.Tech. (Communication Systems) | B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation) |
| | | M.Tech.(VLSI and Embedded Systems) | B.E./ B.Tech. in ECE / Electronics / EIE / ICE / EEE |
| | | M.Tech.(Signal Processing) | |
| 06. | ECE Department jointly with Physics Dept | M.Tech. (Optoelectronics and Laser Technology) | B.E./B.Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics) |
| 07. | Electronics and Instrumentation Engineering | M.Tech. (Electronics and Instrumentation Engineering) | B.E./ B.Tech. (EIE/ICE/Electronics/ ECE/EEE) |
| 08. | Computer Science and Engineering | M.Tech. (Computer Science and Engineering) | B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ ICE/Electronics) MCA |
| | | M.Tech. (Software Engineering) | B.E. / B.Tech. (CSE / IT) MCA |
| | | M.Tech (Network Security) | B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ ICE/Electronics) MCA |
| | | M.Tech (Computer and Predictive Analytics) | |
| | | M.Tech. (Computer Science and Engineering with specialization in Big Data Analytics) | |
| 09 | Information Technology | M.Tech. (Information Technology) | B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ ICE/ Electronics) MCA |
| | | M.Tech. (Information Security & Digital Forensics) | |

## ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

| Sl. No. | Name of the Department | P.G. Programmes offered | Qualifications for admission |
|---|---|---|---|
| 10 | Computer Applications | M.C.A. | Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level |
| | | M.C.A. (Full Time) – (Lateral Entry) | B.Sc Computer Science / B.Sc Information Technology / B.C.A |
| | | M.Tech. (Systems Engineering and Operations Research) | BE / B.Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A. |
| | | M.Tech. (Data & Storage Management) | |
| 11 | Mathematics | M.Sc. (Actuarial Science) | Any Degree with Mathematics / Statistics as one of the Subjects of Study. |
| | | M.Sc. Mathematics | B.Sc. (Mathematics) |
| 12 | Physics | M.Sc.(Physics) | B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation) |
| | | M.Sc. (Material Science) | |
| 13 | Chemistry | M.Sc.(Chemistry) | B.Sc (Chemistry) of B.Sc. (Applied Science) |
| 14 | Life Sciences | M.Sc. Molecular Biology & Biochemistry | B.Sc. in any branch of Life Sciences |
| | | M.Sc. Genetics | B.Sc. in any branch of Life Sciences |
| | | M.Sc. Biotechnology | B.Sc. in any branch of Life Sciences |
| | | M.Sc. Microbiology | B.Sc. in any branch of Life Sciences |
| | | M.Sc. Bioscience | B.Sc. in any branch of Life Sciences |
| | | M.Tech. Biotechnology | B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences |

**3.6** The curriculum of PG programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

| Programme | Minimum prescribed credit range |
|---|---|
| M.Tech. | 75 to 85 |
| M.C.A. | 120 to 130 |
| M.Sc. | 75 to 85 |

**3.7** Credits will be assigned to the courses for all P.G. programmes as given below:

* One credit for one lecture period per week
* One credit for one tutorial period per week
* One credit each for seminar/practical session/project of two or three periods per week
* One credit for two weeks of industrial internship.

3.8 The number of credits registered by a student in non-project semester and project semester should be within the range specified below:

| P.G. Programme | Non-project Semester | Project semester |
|---|---|---|
| M.Tech. (Full Time) | 15 to 29 | 12 to 20 |
| M.Tech. (Part Time) | 6 to 18 | 12 to 16 |
| M.C.A. (Full Time) | 15 to 29 | 12 to 20 |
| M.Sc. (Full Time) | 15 to 25 | 12 to 20 |

**3.9** The electives from the curriculum are to be chosen with the approval of the Head of the Department.

**3.10** A student may be permitted by the Head of the Department to choose electives offered from other PG programmes either within the Department or from other Departments up to a maximum of three courses during the period of his/her study, provided the Heads of the Departments offering such courses also agree.

**3.11** To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A student may be permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Chairman, Academic Council before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

**3.12** The medium of instruction, examination, seminar and project/thesis/ dissertation reports will be English.

**3.13** Industrial internship, if specified in the curriculum shall be of not less than two weeks duration and shall be organized by the Head of the Department.

**3.14 PROJECT WORK/THESIS/DISSERTATION**

**3.14.1** Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department.

**3.14.2** A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

**3.14.3** Project work / Thesis / Dissertation (Phase - II in the case of M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

**3.14.4** The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

**3.14.5** The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

**3.14.6** If a student fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

**3.14.7** A student who has acquired the minimum number of total credits prescribed in the Curriculum for the award of Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

**4.0 CLASS ADVISOR AND FACULTY ADVISOR**

**4.1 CLASS ADVISOR**

A faculty member will be nominated by the HOD as Class Advisor for the whole class.

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

## 4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment every semester.

## 5.0 CLASS COMMITTEE

**5.1** Every class of the PG Programme will have a Class Committee constituted by the Head of the Department as follows:

i. Teachers of all courses of the programme

ii. One senior faculty preferably not offering courses for the class, as Chairperson.

iii. Minimum two students of the class, nominated by the Head of the Department.

iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member

v. Professor in-charge of the PG Programme - Ex-Officio Member.

**5.2** The Class Committee shall be constituted by the respective Head of the Department of the students.

**5.3** The basic responsibilities of the Class Committee are to review periodically the progress of the classes to discuss problems concerning curriculum and syllabi and the conduct of classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and Dean (Academic Affairs). The class committee, without the student members, will also be responsible for finalization of the semester results and award of grades.

**5.4** The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first assessment and the third, after the semester-end examination to finalize the grades.

## 6.0 COURSE COMMITTEE

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

## 7.0 REGISTRATION AND ENROLMENT

**7.1** For the first semester every student has to register and enroll for all the courses.

**7.2** For the subsequent semesters registration for the courses will be done by the student during a specified week before the semester-end examination of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Adviser for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Adviser.

**7.3** From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

**7.4** A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Adviser. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

**7.5** Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

**7.6** Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (Academic Affairs), on the recommendation of the HOD, is permitted.

**7.7** Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

**7.8 A student should have registered for all preceding semesters before registering for a particular semester.**

## 8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. Such student has to rejoin only in the same semester from where he left. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

## 9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

**9.1** A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

| **Programme** | **Minimum No. of credits to be earned to enroll for project semester** |
|---|---|
| M.Tech. (Full time) | 18 (III semester) |
| M.Tech. (Part time) | 18 (V semester) |
| M.C.A. (Full time) | 45 (V semester) |
| M.C.A. (Full time) – (Lateral Entry) | 22 (V semester) |
| M.Sc.(Full time) | 30 (IV semester) if project is in IV semester<br>18 (III semester) if project is in III semester |

**9.2** If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

## 10.0 DISCIPLINE

**10.1** Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the Institution.

**10.2** Any act of indiscipline of a student reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

**10.3** Every student should have been certified by the HOD that his / her conduct and discipline have been satisfactory.

## 11.0 ATTENDANCE

**11.1** Attendance rules for all Full Time Programme and Part time - day Time Programmes are given in the following sub-clause.

**11.2** Ideally every student is expected to attend all classes and earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% for genuine reasons like on medical grounds, representing the University in approved events etc., to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the student should register for and repeat the course when it is offered next. If the course is an elective, either he/she can register and repeat the same elective or can register for a new elective.

**11.3** The students who have not attended a single hour in all courses in a semester and awarded 'I' grade are not permitted to write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

## 12.0 SUMMER TERM COURSES

**12.1** Summer term courses may be offered by a department on the recommendation of the Departmental Consultative Committee and approved by the Dean (Academic Affairs). No student should register for more than three courses during a summer term.

**12.2** Summer term courses will be announced by the Head of the department at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

**12.3** The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters.

Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters, if they wish to improve their continuous assessment marks subject to the approval of the Head of the department.

**12.4** Withdrawal from a summer term course is not permitted. No substitute examination will be conducted for the summer term courses.

## 13.0 ASSESSMENTS AND EXAMINATIONS

**13.1** The following rule shall apply to the full-time and part-time PG programmes (M.Tech./ M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided in the Class Committee will be announced to the students right from the beginning of the semester by the course teacher.

**13.2** There shall be one examination of three hours duration, at the end of the semester, in each lecture based course.

**13.3** The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.

**13.4** At the end of industrial internship, the student shall submit a certificate from the organization and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

## 14.0 WEIGHTAGES

**14.1** The following shall be the weightages for different courses:

**(i) Lecture based course**

| | |
|---|---|
| Two continuous assessments | - 50% |
| Semester-end examination | - 50% |

**(ii) Laboratory based courses**

| | |
|---|---|
| Laboratory work assessment | - 75% |
| Semester-end examination | - 25% |

**(iii) Project work**

| | |
|---|---|
| Periodic reviews | - 50% |
| Evaluation of Project Report by External Examiner | - 20% |
| Viva-Voce Examination | - 30% |

**14.2** Appearing for semester end examination for each course (Theory and Practical) is mandatory and a student should secure a minimum of 40% marks in semester end examination for the successful completion of the course.

**14.3** The markings for all tests, tutorial, assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per the weightages given in clause 13.1.

## 15.0 SUBSTITUTE EXAMINATION

**15.1** A student who has missed for genuine reasons any one of the three assessments including semester-end examination of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.

**15.2** A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

## 16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

**16.1** Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

| Letter grade | Grade points |
|---|---|
| S | 10 |
| A | 9 |
| B | 8 |
| C | 7 |
| D | 6 |
| E | 5 |
| U | 0 |
| W | - |
| I | - |
| AB | - |

Flexible range grading system will be adopted

**“W”** denotes withdrawal from the course.

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

**"U"** denotes unsuccessful performance in a course.

**“AB”** denotes absent for the semester end examination

**16.2** A student is considered to have completed a course successfully if he / she secure five grade points or higher. A letter grade ‘U’ in any course implies unsuccessful performance in that course.

**16.3** A course successfully completed cannot be repeated for any reason.

## 17.0 AWARD OF LETTER GRADE

**17.1** A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different courses will be finalized at the meeting.

**17.2** After finalization of the grades at the class committee meeting the Chairman will forward the results to the Controller of Examinations, with copies to Head of the Department and Dean (Academic Affairs).

## 18.0 DECLARATION OF RESULTS

**18.1** After finalization by the Class Committee as per clause 16.1 the Letter grades awarded to the students in the each course shall be announced on the departmental notice board after duly approved by the Controller of Examinations.

**18.2** In case any student feels aggrieved about the results, he/she can apply for revaluation after paying the prescribed fee for the purpose, within one week from the announcement of results.

A committee will be constituted by the concerned Head of the Department comprising of the Chairperson of the concerned Class Committee (Convener), the teacher concerned and a teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised marks to the Controller of Examinations with full justification for the revision, if any.

**18.3** The “U” and “AB” grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

## 19.0 COURSE REPETITION AND ARREARS EXAMINATION

**19.1** A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

**19.2** A student who is awarded "U" or "AB" grade in a course shall write the semester-end examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses.

**19.3** A student who is awarded "U" or "AB" grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination.

**19.4** If any student obtained "U" or "AB" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

**19.5** If a student with "U" or "AB" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

**20.0 GRADE SHEET**

**20.1** The grade sheet issued at the end of the semester to each student will contain the following:

(i) the credits for each course registered for that semester.

(ii) the performance in each course by the letter grade obtained.

(iii) the total credits earned in that semester.

(iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

**20.2** The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad Where\ \ n = number\ of\ courses$$

where Ci is the number of credits assigned for $i^{th}$ course

$GP_i$ - Grade point obtained in the $i^{th}$ course

For the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point of time.

**'I' and 'W' grades will be excluded for GPA calculations.**

**'U', 'AB' 'I' and 'W' grades will be excluded for CGPA calculations.**

**20.3** Classification of the award of degree will be as follows:

| CGPA | Classification |
|---|---|
| 8.50 and above, having completed all courses in first appearance | First class with Distinction |
| 6.50 and above, having completed within a period of 2 semesters beyond the programme period | First Class |
| All others | Second Class |

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the PG Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause 8). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

## 21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

**21.1** A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,

ii) no disciplinary action is pending against him/her.

**21.2** The award of the degree must be approved by the University.

## 22.0 POWER TO MODIFY

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

# CURRICULUM & SYLLABI FOR M.Tech. (SOFTWARE ENGINEERING)

## (FOUR SEMESTERS / FULL TIME)

## CURRICULUM

### SEMESTER I

| Sl. No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | MAB6189 | Statistical Methods and Queuing Theory | 3 | 1 | 0 | 4 |
| 2 | CSB6122 | Advanced Database Technology | 3 | 0 | 2 | 4 |
| 3 | CSB6123 | Software Requirement Analysis and Estimation | 3 | 0 | 0 | 3 |
| 4 | CSB6104 | Computer Networks And Management | 3 | 0 | 2 | 4 |
| 5 | | Elective-I | 3 | 0 | 0 | 3 |
| 6 | CSB6101 | Research Methodology for Engineers | 3 | 1 | 0 | 4 |
| 7 | CSB6124 | Case Tools lab | 0 | 0 | 3 | 1 |
| 8 | CSB6125 | Term Paper | 0 | 0 | 2 | 1 |
| | | | | | | **24** |

### SEMESTER II

| Sl. No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | CSB6231 | Software Design and Architecture | 3 | 0 | 0 | 3 |
| 2 | CSB6232 | Information Security | 3 | 0 | 0 | 3 |
| 3 | CSB6233 | Software Testing and Quality Assurance | 3 | 0 | 0 | 3 |
| 4 | CSB6234 | Formal Methods for Software Engineering | 3 | 0 | 0 | 3 |
| 5 | | Elective - II | 3 | 0 | 0 | 3 |
| 6 | | Elective - III | 3 | 0 | 0 | 3 |
| 7 | CSB6235 | Software Design (Case Study) | 0 | 0 | 3 | 1 |
| 8 | CSB6236 | Software Quality Assurance lab | 0 | 0 | 3 | 1 |
| | | | | | | **20** |

**SEMESTER III**

| Sl. No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | | Elective IV | 3 | 0 | 0 | 3 |
| 2 | | Elective V | 3 | 0 | 0 | 3 |
| 3 | | Elective VI | 3 | 0 | 0 | 3 |
| 4 | CSB7201 | Software Project Management | 3 | 0 | 0 | 3 |
| 5 | CSB7221 | Project - Phase I | 0 | 0 | 12 | 6* |
| | | | | | | **15** |

**SEMESTER IV**

| Sl. No | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | CSB7221 | Project - Phase II | 0 | 0 | 36 | 18* |
| | | | | | | **18 + 6 = 24** |

*Credits for Project Work (Phase I) to be accounted along with Project work (Phase II) of IV Semester

**TOTAL CREDITS: 80**

## LIST OF ELECTIVES

| Sl. No | Course Code | Course |
|---|---|---|
| 1 | CSBY01 | Theory of computation |
| 2 | CSBY02 | Soft Computing |
| 3 | CSBY03 | Mobile Computing |
| 4 | CSBY26 | Distributed Systems |
| 5 | CSBY04 | Web Technology |
| 6 | CSBY05 | XML and Web Services |
| 7 | CSBY06 | Multimedia Systems |
| 8 | CSBY27 | Software Agents |
| 9 | CSBY08 | Embedded Systems |
| 10 | CSBY28 | IT System Management |
| 11 | CSBY10 | Mobile Ad hoc Networks |
| 12 | CSBY11 | Data warehousing and Data mining |
| 13 | CSBY12 | Performance evaluation of Computer systems and Networks |
| 14 | CSBY13 | Agent Based Intelligent Systems |
| 15 | CSBY29 | Personal Software Process |
| 16 | CSBY30 | Team Software Process |
| 17 | CSBY31 | Software Engineering for Image processing |
| 18 | CSBY24 | Service Oriented Architecture |
| 19 | CSBY32 | Principles of Grid Computing |
| 20 | CSBY33 | Pervasive Computing |
| 21 | CSBY34 | User interface design |
| 22 | CSBY35 | Software maintenance |
| 23 | CSBY36 | Multimodal Computing |
| 24 | CSBY25 | Cloud Computing |
| 25 | SSBY01 | Society, Technology and sustainability |

## SEMESTER I

**MAB 6189 STATISTICAL METHODS AND QUEUING THEORY**

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

**OBJECTIVES:**

- To teach about the probability and Random variable of the various functions. It also helps to understand the various statistical methods including the Design of experiments.
- To expose the students to apply certain probability, statistical and operational research concepts in practical applications of computer science areas.

**PREREQUISITES:**

- Engineering Mathematics

**MODULE I BASIC PROBABILITY** **8**

Axioms of probability – Addition and Multiplication theorem – Conditional probability – Total Probability – Random variables.

**MODULE II DISTRIBUTIONS** **8**

Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions – Moments – Moments generating functions and their properties – Function of random variables.

**MODULE III ESTIMATION THEORY** **8**

Partial and Multiple correlations – Partial and multiple regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

**MODULE IV TESTING OF HYPOTHESIS** **7**

Basic definitions of statistical hypothesis – Tests based on Normal, T, Chi – square and F distributions for mean, variance and proportion.

**MODULE V DESIGN OF EXPERIMENTS** **7**

Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design – 22 factorial designs.

**MODULE VI QUEUING THEORY** **7**

Characteristics of Queuing Models – Poisson Queues - (M / M / 1): (FIFO / 8 /8), (M/M/C): (FIFO / 8 / 8), models.

**L – 45; T – 15; Total Hours: 60**

**REFERENCES:**


1. Taha H.A, "Operations Research: An Introduction", 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
2. Walpole R.E., Myer R.H, Myer S.L. and Ye. K, "Probability and Statistics for Engineers and Scientists", 7th Edition, Pearson Education, Delhi, 2002.
3. Goel B.S. and Mittal S.K, "Operations Research", Pragati Prakashan, Meerut, 2000.
4. Winston. W.L. "Operations Research", 4th Edition, Thompson-Brooks/Cole, 2003.
5. Sheldon M. Ross, "Introduction to Probability Models", 10th Edition, Academic Press, USA, 2010.
6. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2011.
7. R. Lyman Ott, Michael Longnecker, "An Introduction to Statistical Methods and Data Analysis", 6th Edition, Brooks/Cole Cengage Learning, USA, 2010.


**OUTCOMES:**

Students who complete this course will be able to

- acquire skills in handling situations involving more than one random variable and functions of random variables.
- explain the notion of sampling distributions and complete simple problems using statistical techniques useful in making rational decisions in management problems.
- apply the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
- apply the basic queuing models.

**CSB6122 ADVANCED DATABASE TECHNOLOGY L T P C**

**3 0 2 4**

**OBJECTIVES:**

- To emphasize the practical and theoretical aspects of advanced topics in databases, such as object-relational databases and data warehouses.
- To disseminate the various data analysis techniques.
- To expose the main techniques for developing database systems.

**PREREQUISITES:**

- Database Management System

**MODULE I DATABASE MANAGEMENT 8**

Relational data model - SQL - Database design - Entity-Relationship model - Relational normalization - Embedded SQL - Dynamic SQL - JDBC – ODBC.

**MODULE II ADVANCED DATABASES 7**

Object databases - Conceptual object data model - XML and Web Data - XML Schema - Distributed data bases - OLAP and Data Mining - ROLAP and MOLAP.

**MODULE III QUERY AND TRANSACTION PROCESSING 7**

Query processing basics - Heuristic optimization - Cost, size estimation - Models of transactions - Architecture - Transaction processing in a centralized and distributed system - TP monitor.

**MODULE IV IMPLEMENTING AND ISOLATION 8**

Schedules - Concurrency control - Objects and semantic commutatively - Locking -Crash, Abort and Media failure - Recovery - Atomic termination - Distributed deadlock - Global serialization - Replicated databases - Distributed transactions in real world.

**MODULE V DATABASE DESIGN ISSUES 7**

Security - Encryption - Digital signatures - Authorization - Authenticated RPC - Integrity - Consistency - Database tuning - Optimization and research issues.

**MODULE VI CURRENT ISSUES** **8**

Rules - Knowledge Bases - Active and Deductive Databases – Multimedia Databases – Multimedia Data Structures – Multimedia Query languages - Spatial Databases.

**L-45; P-15; Total Hours: 60**

**REFERENCES:**

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2006.
2. Philip M. Lewis, Arthur Bernstein and Michael Kifer, "Databases and Transaction Processing:An Application Oriented Approach", 2nd Edition, Addison Wesley, 2005.
3. Abraham Silberschatz, Henry. F. Korth and S.Sudharsan, "Database System Concepts", 4th Edition, Tata McGraw Hill, 2004.
4. Raghu Ramakrishna and Johannes Gehrke,"Database Management Systems, 3rd Edition, Tata McGraw Hill, 2003.

**OUTCOMES:**

Students who complete this course will be able to

- identify an automated database design tool to design complex database systems.
- apply object-relational data model concepts in database modeling and design.
- optimize recovery of database transactions in relevant application.

| CSB6123 | SOFTWARE REQUIREMENTS ANALYSIS AND ESTIMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To enable the students to identify understand the role of requirement engineering in software engineering.
- To make the students to be aware of the fundamentals of software costing and pricing.
- To analyze the concept of risk management.

**PREREQUISITES:**

- Software Engineering

**MODULE I THE CONTEXT OF SOFTWARE REQUIREMENTS 7**

The Software Crisis – Software Estimation – Software Lifecycle – Software Projects – Management Activities in a Software Project – Requirement Engineering – Software Engineering.

**MODULE II SOFTWARE REQUIREMENT DEVELOPMENT 7**

Establishing the product vision and project scope – Finding the voice of customer hearing the voice of customer – Understanding user requirements – Documenting the requirements - Risk reduction through prototyping – Setting requirement priorities – Validating the requirements-Software Process model.

**MODULE III SOFTWARE REQUIREMENT AND RISK MANAGEMENT 8**

Elements of Risk Management – Documenting Project Risks – Planning For Risk Management – Requirements Elicitation – Requirements Analysis – Requirements Specification – Requirements Validation – Requirements Management.

**MODULE IV SOFTWARE REQUIREMENTS ANALYSIS 8**

Size Estimation - Two Views of Sizing- Function Point Analysis- Mark II FPA- Full Function Points – Other Function Point Extensions – Approximate Function Point Computations – Directions in Functional Size Measurements - LOC Estimation - Conversion between Size Measures.

**MODULE V EFFORT, SCHEDULE AND COST ESTIMATION 7**

Productivity - Estimation Factors - Approaches to Effort and Schedule Estimation - COCOMO II - Putnam Estimation Model – Using Complexity As Estimator – Estimation By Analogy - Algorithmic Models –Bottom Up Estimation - Cost Estimation – Validating Software Estimates.

**MODULE VI SOFTWARE ESTIMATION TOOLS 8**

Desirable features in software estimation tools- IFPUG- USC's COCOMO II - SLIM (Software Life Cycle Management) Tools.

**Total Hours: 45**

**REFERENCES:**

1. Ian Sommerville,"Software Engineering", 8th Edition, Pearson Education India, 2008.
2. Karl E Wiegers , Joy Beatty ," Software Requirements", 3rd Edition, Microsoft, 2012.
3. Swapna Kishore, Rajesh Naik, "Software Requirements and Estimation", 1st Edition, Tata McGraw Hill , 2001.

**OUTCOMES:**

Students who complete this course will be able to

- explain the role of software requirements development.
- explore the costs and risks of the requirements process and its relationships to the rest of the software development life cycle.
- develop different design solutions to a given problem and recommend the best one within limitations of cost, time, knowledge, existing systems and organizations.

| CSB6104 | COMPUTER NETWORKS AND MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, NS,SE, CSE-BDA)) | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

- To gain knowledge on the basic concepts of computer networks and OSI network model.
- To introduce the operation and management of computer networks.
- To understand the paradigms and functions of network management.
- To study the underlying applications and tools for network management.
- To acquire knowledge on broadband networks and its services.

**PREREQUISITES:**

- Operating System

**MODULE I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY** **7**

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards.

**MODULE II OSI NETWORK MANAGEMENT** **7**

OSI Network management model- Organizational model -Information model, Communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS.

**MODULE III INTERNET MANAGEMENT** **7**

SNMP-Organizational model-System Overview - The information model - Communication Model - Functional model - SNMP proxy server- Management information, protocol remote monitoring.

**MODULE IV BROADBAND NETWORK MANAGEMENT** **8**

Broadband networks and services - ATM Technology-VP,VC - ATM Packet - Integrated service - ATMLAN emulation - Virtual LAN - ATM Network Management - ATM Network reference model, integrated local management Interface - ATM Management Information base-Role of SNMD and ILMI in

ATM Management- M1, M2, M3, M4 Interface- ATM Digital Exchange Interface Management.

**MODULE V NETWORK MANAGEMENT APPLICATIONS 8**

Configuration management - Fault management - Performance management - Event Correlation Techniques security Management - Accounting management - Report Management- Policy Based Management Service Level Management.

**MODULE VI APPLIED NETWORK MANAGEMENT 8**

The Need for Management Integration- Management Integration challenge - Approaches to Management Integration- Service Level Management-The Motivation for Service Level Agreements - Identification of Service Level Parameters - Defining a Service Level Agreement- Managing for a Service Level.

**L- 45; P-15; Total Hours: 60**

**REFERENCES:**

1. Mani Subramanian, "Network Management: Principles and Practices", 2nd Edition, Prentice Hall, 2012.
2. Alexander Clemm, "Network Management Fundamentals", 1st Edition, Cisco Press, 2006.
3. Adrian Farrell, "Network Management Know It All", 1st Edition, Elsevier India, 2008.
4. Richard Burke, "Network Management: Concepts & Practice, A Hands on Approach", 1st Edition, Prentice Hall, 2003.

**OUTCOMES:**

Students who complete this course will be able to

- correlate the fundamental importance of network information management related to the business objectives of an organization.
- use computer network management tools and the systems.
- apply the basic knowledge of current developments in information and communication technologies, standards and applications to network related applications.
- visualize the effectiveness of Broadband networks and services.

**CSB6101 RESEARCH METHODOLOGY FOR ENGINEERS** **L T P C**

**(Common to M.Tech (CSE, SE, NS, IT, IS & DF, CPA,CSE-BDA))** **3 1 0 4**

**OBJECTIVES:**

- To make the students well versed in Data analysis.
- To describe the steps involved in research process.
- To explain them how to formalize research problems.
- To discuss clearly the approaches for research through some case studies.

**PREREQUISITES:**

- Engineering Mathematics
- Operational Research

**MODULE I RESEARCH PROBLEM** **8**

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

**MODULE II SAMPLING DESIGN AND SCALING TECHNIQUES** **7**

Census and Sample survey – Steps in Sampling Design – Different types of Sample Designs – Complex Random Sampling Designs – Measurement scales – Techniques of Developing Measurement Tools – Scaling – Important Scaling Techniques.

**MODULE III METHODS OF DATA COLLECTION AND ANALYSIS OF DATA** **8**

Collection of Primary Data – different types – Some other methods of Data Collection – Collection of Secondary Data – Processing Operations – Types of Analysis – Measures of Central tendency – Measures of Dispersion.

**MODULE IV LINEAR PROGRAMMING** **10**

Basic of Operations Research(OR): Characteristics of Operations Research – OR and Decision making- Linear programming – Stimulation and Graphical

solution of canonical and standard forms of Linear programming problem – Algebraic solution – Simplex method – Charne's method of penalties – Concept of duality – Properties of duality.

**MODULE V TRANSPORTATION AND ASSIGNMENT MODELS 6**

Transportation Problem – Assignment Problem – Travelling Salesman Problem.

**MODULE VI CASE STUDIES 6**

Presentation by students on their area of research.

**L – 45; T – 15; Total Hours: 60**

**REFERENCES:**

1. Kothari, C.R., "Research Methodology: Methods and Techniques", 2nd Edition, New Age International, New Delhi, 2012.
2. Nicholas Walliman, "Your Research Project", 2nd Edition, Vistaar Publication, New Delhi, 2005.
3. Taha H.A., "Operations Research: An Introduction", 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
4. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2011.

**OUTCOMES:**

Students who complete this course will be able to

- identify the research problem.
- become capable of analyzing the data using mathematical techniques.
- learn to apply the probability concepts in research.
- demonstrate the different research methods applicable to a specific problem.

| CSB6124 | CASE TOOLS LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1 |

**OBJECTIVES:**

- To know how CASE (Computer Aided Software Engineering) tools are used in various stages of the Software Development Life Cycle.
- To give the analysis elements of the project and define the association between them.
- To become familiar with UML(Unified Modeling Language).
- To learn how to test the developed software using Rational Rose.

1. Problem Analysis and Project Planning Thorough study of the problem – Identify project scope, Objectives, infrastructure
2. Software Requirement Analysis Describe the individual Phases/ modules of the project, Identify deliverables.
3. Data Modelling Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. Software Development and Debugging.
5. Software Testing Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

**PREREQUISITES:**

- Object Oriented Analysis and Design

**List of Experiments:**

1. Quiz System.
2. Online ticket reservation system.
3. Remote computer monitoring.
4. Student marks analysing system.
5. Expert system to prescribe the medicines for the given symptoms.

6. ATM system.
7. Platform assignment system for the trains in a railway station.
8. Stock maintenance.
9. E-mail Client system.
10. Payroll System.
11. Course Registration System.
12. Real-Time Scheduler.

**Software Required:**

Case Tools: Rational Suite, Win runner, Empirix.

Languages: C/C++/JDK 1.3, JSDK, INTERNET EXPLORER, UML. Front End: VB, VC++, Developer 2000.

Back End: Oracle, MS-Access, SQL.

**OUTCOMES:**

Students who complete this course will be able to

- analyze a problem using different UML diagrams and design the architecture for a problem.
- develop coding and apply CASE tool in all the phases of software development.
- draw Use case diagram, Class diagram, Sequence diagram and collaboration diagram.
- test the software, memory usage of the software and validate the Test cases using Rational Rose.

## SEMESTER II

| CSB6231 | SOFTWARE DESIGN AND ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To gain knowledge on the challenges of advanced software design and various issues relating to software design.
- To understand the tools and techniques for the automatic analysis and evaluation of software.
- To introduce various software design techniques.
- To acquire knowledge on the various Architectural styles and patterns.

**PREREQUISITES:**

- Software Engineering

**MODULE I INTRODUCTION 8**

The Architecture Business Cycle: Where do architectures come from - Software processes and the architecture business cycle - what makes a “good” architecture? - What software architecture is and what it is not, other points of view - Architectural patterns, reference models and reference architectures - Importance of software architecture - Architectural structures and views.

**MODULE II ARCHITECTURAL STYLES AND CASE STUDIES 8**

Architectural styles - Pipes and filters - Data abstraction and object-oriented organization - Event-based, implicit invocation - Layered systems – Repositories – Interpreters - Process control - Other familiar architectures - Heterogeneous architectures. Case Studies: Keyword in Context - Instrumentation software - Mobile robotics - Cruise control - Three vignettes in mixed style.

**MODULE III NON FUNCTIONAL REQUIREMENTS 9**

Functionality and architecture - Architecture and quality attributes - System quality attributes - Quality attribute scenarios in practice - Other system quality attributes - Business qualities - Architecture qualities. Achieving Quality: Introducing tactics - Availability tactics - Modifiability tactics - Performance

tactics - Security tactics - Testability tactics - Usability tactics - Relationship of tactics to architectural patterns - Architectural patterns and styles.

**MODULE IV ARCHITECTURAL PATTERNS – 1** **6**

Introduction from mud to structure: Layers, Pipes and Filters, Blackboard.

**MODULE V ARCHITECTURAL PATTERNS – 2** **7**

Distributed Systems: Broker - Interactive Systems: MVC, Presentation-Abstraction-Control.

**MODULE VI DESIGN PATTERNS** **7**

Structural decomposition: Whole – Part; Organization of work: Master – Slave - Access Control: Proxy.

**Total Hours: 45**

**REFERENCES:**

1. Paul Clements, Rick Kazman, “Software Architecture in Practice – Len Bass”, 2nd Edition, Pearson Education, 2003.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, “Pattern-Oriented Software Architecture, A System of Patterns”, 2nd Edition, Volume 1, John Wiley and Sons, 2008.
3. Mary Shaw and David Garlan,”Software Architecture- Perspectives on an Emerging Discipline”, Prentice-Hall of India, 2007.

**OUTCOMES:**

Students who complete this course will be able to

- apply the principles behind software patterns to design real time applications.
- acquire practical competence in the usage and application of tools to support automated software analysis.
- adopt different architectural styles for designing a system.

| CSB6232 | INFORMATION SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (SE, NS)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To explain clearly about security policies and the major mechanisms for implementing security policies.
- To disseminate how threats to an organization are discovered, analyzed and dealt with.
- To train on procedures and practices for information security services.

**PREREQUISITES:**

- Computer security and Computer Networks

**MODULE I INTRODUCTION TO INFORMATION SECURITY 8**

Introduction-History of information security-What is security-Need for security-CNSS security model-Components of an information system-Balancing information security and access-System development life cycle-Security systems development life cycle- Threats-Attacks-Secure software development.

**MODULE II RISK MANAGEMENT 7**

Introduction- Risk identification- Assessment- Control strategies- Selecting a risk control strategy – Quantitative versus Qualitative risk control practices.

**MODULE III PLANNING FOR SECURITY 8**

Introduction-Information security planning and governance- Information security policy, standards and practices-Cryptographic tools-protocols for secure communications-Attacks on cryptosystems.

**MODULE IV PHYSICAL SECURITY 7**

Introduction-Physical access controls-Fire Security and safety-Failure of supporting utilities and structural collapse-Interception of Data-Remote computing security.

**MODULE V IMPLEMENTING INFORMATION SECURITY 7**

Information security project management-Technical aspects of implementation-Non technical aspects of implementation- Positioning and staffing the security function.

**MODULE VI SOCIAL AND HUMAN ELEMENTS OF INFORMATION SECURITY 8**

Human and Social Aspects of Password Authentication- Impact of the Human Element on Information Security-Social and Human Elements of Information Security: A Case Study-Security Configuration for Non-Experts: A Case Study in Wireless Network Configuration.

**Total Hours: 45**

**REFERENCES:**

1. James Michael Stewart, Ed Tittel and Mike Chapple, “Principles of Information Security”, 3rd Edition, John Wiley & Sons, 2011.
2. Jason Andress, “The Basics of Information Security”, 1st Edition, Syngress Press, Elsevier Publications, 2011.
3. Merkow, “Information Security: Principles and Practices”, 2nd Edition, Pearson Education India, 2007.

**OUTCOMES:**

Students who complete this course will be able to

- analyze the major information security threats to any organization.
- apply security policies, standards and practices.
- implement authorization techniques to reduce security threats.

| CSB6233 | SOFTWARE TESTING AND QUALITY ASSURANCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the theoretical aspects of software testing.
- To demonstrate the knowledge of the existing testing methods.
- To expose to various industrial practices on software testing and quality assurance strategies
- To develop into a software tester and quality controller

**PREREQUISITES:**

- Software Engineering

**MODULE I TESTING PRINCIPLES 8**

Testing as an Engineering activity – TMM – Testing fundamentals – Testing as a process - Defects – Defect hypotheses and tests - Strategies and methods for test case design – Black Box approach – Random testing – Equivalence class partitioning – Boundary value analysis – Other approaches – White box approach – Test adequacy criteria – Mapping white box testing methods with TMM.

**MODULE II LEVELS OF TESTING AND TEST PLAN 8**

Need for levels of testing – Unit testing – Test harness – Integration test – Strategies and procedures – Integration test plan – Different types of system tests – Regression test – alpha beta acceptance test – Role of use cases – mapping levels of testing with TMM - Test planning – components and attachments – reporting test results – Test specialist – Tester certifications – study on testing software.

**MODULE III DEFECT ANALYSIS AND PREVENTION 5**

Processes and Defects - History of Defect Analysis and Prevention - Necessary Support for a Defect Prevention Program - Techniques for Defect Analysis - Defect Causal Analysis - The Action Team: Making Process Changes - Monitoring Actions and Process Changes - Benefits of a Defect Prevention Program - Defect Prevention and the Three Critical Views- Defect removal analysis – Defect removal effectiveness and process maturity level.

**MODULE IV SOFTWARE METRICS** **8**

Scope of software metrics, Classifying software measures, Measurement basics – representational theory, scales, meaningfulness, What to measure – GOM technique, Control flow structure, product quality metrics – MTTF, defect density, customer problems, customer satisfaction, function point, Metrics for software maintenance, In-process quality metrics.

**MODULE V QUALITY ASSURANCE** **8**

Quality concepts – quality, quality control, quality assurance, cost of quality Software quality assurance – SQA activities, software reviews, inspections, audits, Software reviews, inspections, audits, Software reliability Quality Attributes: correctness, reliability, usability, integrity, portability, maintainability, interoperability. Ishikawa's Seven Basic Tools.

**MODULE VI QUALITY STANDARDS** **8**

Basic concept of – ISO 9000 & 9001, CMM, six sigma.- Real time case study on testing practices in the industry – Study on various certification procedures to become a professional tester

**TOTAL HOURS: 45**

**REFERENCES :**

1. Ilene Burnstein, practical Software Testing: A Process-Oriented Approach, Springer Professional Computing, 2003.
2. William Perry, "Effective Methods For Software Testing", 3rd Edition, Wiley publications, 2006.
3. Glenford J. Myers, "The Art of Software Testing", 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.
4. Stephen Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Addison-Wesley Professional, 2003.
5. Patton, "Software Testing", 2nd Edition, Pearson Education India, 2006.

## OUTCOMES

Students who complete this course will be able to

- understand and apply the various software testing strategies and apply the same in industrial practices.
- apply software quality controls and ensure quality in a software process.
- design and implement software quality standards and take up a career as a professional software tester

| CSB6234 | FORMAL METHODS FOR SOFTWARE ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the notion of formal methods in software engineering.
- To understand the theoretical foundations of software engineering in terms of basic style, constructs and notations.
- To expose the students to the tools used for formal semantic analysis.

**PREREQUISITES:**

- Discrete Mathematics

**MODULE I INTRODUCTION** **6**

Need for formal Methods – Formal Vs Informal Programming- Software Engineering to Formal Methods – Advantages of Formal Methods – Weaknesses of Formal Methods – A Survey of Formal Methods.

**MODULE II LOGICAL TOOLS** **8**

Applications of Logic – Antecedents - Branches of Logic - Propositional Logic – Predicate Logic - Mathematical Reminders – Relationships and Ordinals - Computability - Hoare Logic.

**MODULE III Z NOTATION** **8**

The Interchange Language – User Defined Identifiers – Data Types – Basic Types – Compound Types – Schemas – Additional Constructs.

**MODULE IV VDM** **8**

Introduction to VDM – Basic Types – Quote Types – Compound Types – Optional Types - Functions - Operations – Additional Constructs.

**MODULE V FORMAL SEMANTICS AND TOOLS** **8**

Operational Semantics – Denotation Semantics – Axiomatic Semantics – Proof Editors - Proof Analyzer – Symbolic Simulators –Translators – Test Generation Tools.

**MODULE VI FORMAL METHODS FOR COMPLEX SOFTWARE SYSTEMS** **7**

Formal Specification Techniques and Software Architectures - Formal Analysis Techniques – Element Level Analysis – Composition Analysis – Refinement Analysis.

**Total Hours: 45**

**REFERENCES:**

1. Hossam A. Gabbar, “Modern Formal Methods and Applications”, 1st Edition, Springer, 2010.
2. Jean-Francois Monin, “Understanding Formal Methods”, 1st Edition, Springer, 2003.

**OUTCOMES:**

Students who complete this course will be able to

- apply the notations for requirement specifications.
- use formal semantic tools for software documentation.
- analyze complex software systems using formal methods.

| CSB6235 | SOFTWARE DESIGN (CASE STUDY) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1 |

**OBJECTIVES:**

- To give hands on experience on tools and techniques for design practices.
- To acquire training on the preparation of Software Requirement Specification document
- To give training on the preparation of design document.
- To highlight various design methods used for solving real life problems.
- To enhance soft skills, team building and technical writing skills.

**PREREQUISITES:**

- Software Engineering

**METHODOLOGY OF ASSESSMENT**

- The class can be grouped as teams of not more than three in a team.
- Each team can present their observations based on the parameters given.
- Each team should prepare and deliver a presentation on the contents of the documents such as the SRS and Design document.
- Case Study problems may be selected as per the choice of the students and the Case study may be evaluated on the following parameters
- Problem description and Analysis.
- Requirements Gathering Activities
- Different Techniques adopted for requirements gathering
- Software Requirement Specification Document
- Design Representations.
- Selection of appropriate design methods for the problem.
- Steps Taken to Address the Problem and the Inferences.
- Preparation of design document.
- Challenges and How They were Met
- Communication and clarity of presentation.

**OUTCOMES:**

Students who complete this course will be able to

- prepare an effective SRS document for the given problem
- select and apply appropriate software design methodologies for the problem chosen.
- make use of various tools for design representations.
- adopt the various methods of requirement elicitation and apply them.
- co-ordinate the work in teams in a better manner.

| CSB6236 | SOFTWARE QUALITY ASSURANCE LAB | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1 |

**OBJECTIVES:**

- To provide hands on experience on various software testing tools like Rational Rose Suite, Rational Functional Tester, Rational Performance Tester, Load Runner.
- To plan and design test cases and create test documentation.
- To understand and make use of tools to calculate various software quality metrics.

**PREREQUISITES:**

- Software Engineering

**SOFTWARE TESTING LAB**

1. Study of types of testing :
   a. Unit Testing
   b. Regression Testing
   c. Integration Testing
   d. Validation Testing
   e. Acceptance Testing
   f. System Testing
2. Study of testing Tools:
   a. Study of Any Testing Tool (Win Runner)
   b. Study of any web testing tool (e.g. Selenium)
   c. Study of Any Bug Tracking Tool (Bugzilla, Bugbit)
   d. Study of Any Test Management Tool ( Test Director)
   e. Study of any open source testing tool (Test Link)
3. Prepare test plan and develop test case hierarchy
4. Generate Test cases and Test Documentation in the following case studies
   a. Library System

b. Course Registration System

c. Banking System

d. Student Marks Analyzing System

e. Online Ticket Reservation System

**MEASUREMENTS LAB**

1. Study of software measurements analysis and parameters
2. Object oriented programming development: Compute method inheritance factor weighted method for class.
3. Web application to calculate the following Weighted Method Count (WMC)
   - No of Children (NoC)
   - Depth of Inheritance (DIT)
   - Response for a Class (RFC)
   - Coupling and Cohesion between Objects (CCBO)

**OUTCOMES:**

Students who complete this course will be able to

- demonstrate the various software testing techniques on various software testing tools.
- develop test cases and test documentation.
- implement various levels of testing for any practical application.
- estimate the various factors (such as Weighted Mount Count, Depth of Inheritance, No of Children, etc.,) on a typical web application.

## SEMESTER III

| CSB7201 | SOFTWARE PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, NS, SE, CPA, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To highlight the importance of software project management.
- To discuss various processes in Software Project Management.
- To provide tools and techniques for project monitoring.
- To expose different project management life cycles.

**PREREQUISITES:**

- Software Engineering

**MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 8**

Defining a project- Sequence of Activities – Complex Activities – A Business focused definition - Understanding the Scope Triangle - Managing the Creeps- Importance of Classifying Projects - Fundamentals of Project Management - Introducing Project Management Life Cycles - Choosing the Best-Fit PMLC Model.

**MODULE II PROJECT MANAGEMENT PROCESS GROUPS 8**

Defining the Five Process Groups - Nine Knowledge Areas - Mapping Knowledge Areas to Process Groups - Using Tools, Templates, and Processes to Scope a Project - Managing Client Expectations.

**MODULE III TPM PROJECT 8**

Using Tools, Templates, and Processes to Plan a Project - Application Software Packages- Project Planning Tools – Planning and Conducting Joint Project - Building the WBS - Estimating - Constructing the Project Network Diagram - Effective Project Proposal - Launch a TPM Project- Monitor and Control a TPM Project.

**MODULE IV ESTABLISHING PROJECT MANAGEMENT LIFE CYCLES 7**

Understanding the Complexity/Uncertainty - Traditional Project Management - Incremental Project Management Life Cycle - Agile Project Management -

Iterative Project Management Life Cycle- Adaptive Project Management Life Cycle – Adapting and Integrating the APM Toolkit.

**MODULE V BUILDING AN EFFECTIVE PROJECT MANAGEMENT 7**

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes.

**MODULE VI MANAGING THE REALITIES OF PROJECTS 7**

Prevention and Intervention Strategies for Distressed Projects - Using Tools, Templates and Processes to Prevent Distressed Projects - Organizing Multiple Team Projects - Managing the Professional Development of Project Teams.

**Total Hours: 45**

**REFERENCES:**

1. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 6th Edition, Wiley Publication, 2011.
2. Robert K. Wysocki, “Effective Software Project Management”, 3rd Edition, Wiley Publication, 2010.

**OUTCOMES:**

Students who complete this course will be able to

- design a project management plan using different project management life cycles.
- find a suitable project management life cycle model for effective project execution.
- analyze the risks associated with the projects.

## ELECTIVES

| | | | | | |
|---|---|---|---|---|---|
| **CSBY01** | **THEORY OF COMPUTATION** | **L** | **T** | **P** | **C** |
| | **(Common to M.Tech(CSE, SE, CSE-BDA))** | **3** | **0** | **0** | **3** |

**OBJECTIVES:**

- To explain different abstract machine models of computations mathematically.
- To introduce students to the models of computation, including Turing machines, pushdown automata and deterministic and non-deterministic finite automata.
- To enhance/develop students ability to understand and conduct mathematical proofs for computation.

**PREREQUISITES:**

- Computer Architecture

**MODULE I INTRODUCTION TO FINITE AUTOMATA 8**

Strings – Alphabets – Languages – Inductive Proofs – Finite Automata – Deterministic Finite Automata – Non Deterministic Finite Automata – Equivalence of NFA and DFA – Finite Automata with e–Moves.

**MODULE II REGULAR LANGUAGES 6**

Regular Languages – Regular Expressions and regular Languages – Applications of Regular Expressions – Equivalence of Regular Expressions and NFA with -Moves – Properties of Regular Languages – Pumping Lemma.

**MODULE III CONTEXT FREE GRAMMAR & LANGUAGES 8**

Context Free Grammar – Derivations using Grammar – Leftmost and Rightmost Derivation – Ambiguity – Derivation Trees / Parse Trees – Relationship between Derivation and Derivation Trees – Simplification of Context Free Grammars – Normal forms for Context Free Grammars – CNF and GNF.

**MODULE IV PUSH DOWN AUTOMATA 8**

Definition of PDA – Languages of PDA – Equivalence of Pushdown Automata and Context Free Languages – Deterministic Pushdown Automata - Pumping Lemma for Context Free Language.

**MODULE V COMPUTABILITY** **8**

Turing machine – Storage in State, Multiple Tracks, Subroutines – Turing Machine Construction Techniques – Two Way Infinite Tape – Multitape Turing Machine – Universal Turing machine – Turing Machine and Computers.

**MODULE VI UNDECIDABILITY** **7**

Halting Problem for Turing Machines - Rice Theorem – Unsolvable Problem - Post Correspondence Problem – Properties of Recursive and Recursively Enumerable Languages.

**Total Hours: 45**

**REFERENCES:**

1. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2011.
2. John.C.Martin, "Introduction to languages and Theory of Computation", 3rd Edition, Tata Mc Graw Hill Education, 2010.
3. A.M.Natarajan, A.Tamilarasi and P.Balasubramani, "Theory of Computation", 1st Edition, New Age International Publishers, 2003.
4. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computation", 3rd Edition, IEEE, Prentice Hall of India, 2006.
5. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishing House, 2011.

**OUTCOMES:**

Students who complete this course will be able to

- apply principles to minimize finite automata and grammars of context free languages.
- develop abstract models to simulate complex systems and solve problems on a model of computation.
- categorize problems into solvable and unsolvable constructs.

| CSBY02 | SOFT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, NS, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce new ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To highlight the role of soft computing algorithm.
- To understand the concepts of Genetic algorithm and its applications.

**PREREQUISITES:**

- Artificial Intelligence
- Neural Networks

**MODULE I NEURO FUZZY AND SOFT COMPUTING 7**

Soft computing constituents and Conventional Artificial Intelligence - Neuro fuzzy and soft computing characteristics - Fuzzy sets - Basic definitions - Fuzzy union, intersection and complement - Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations –Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

**MODULE II ARTIFICIAL NEURAL NETWORK 7**

Introduction – Machine Learning Basics - Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Supervised Learning Network: – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

**MODULE III ARTIFICIAL NEURAL NETWORK- II 7**

Associative Memory Networks: Training Algorithms for Pattern Association – Auto associative Memory Network – Hetero associative Memory Network – Bidirectional Associative Memory – Hopfield Networks – Iterative Auto associative Memory Networks – Temporal Associative Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Learning Vector Quantization – Counter

propagation Networks – Adaptive Resonance Theory Networks – Special Networks.

**MODULE IV GENETIC ALGORITHM 8**

Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem –Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming.

**MODULE V NEURO FUZZY MODELING 8**

ANFIS Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - ANFIS as a Universal Approximator - Simulation Examples - Extensions and Advanced Topics.

**MODULE VI APPLICATIONS OF SOFT COMPUTING 8**

A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach – Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

**Total Hours: 45**

**REFERENCES:**

1. Simon O Haykin, “Neural Networks and Learning Machines”, 3rd Edition, Pearson Higher Education, 2008.
2. S.N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, 1st Edition, Wiley India, 2007.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, 8th Edition, Springer, 2007.
4. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, 1st Edition, PHI 2003.
5. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, 2nd Edition, PHI, 2004.

6. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, 1st Edition, Pearson Edition, 2003.

**OUTCOMES:**

Students who complete this course will be able to

- apply the theoretical and practical knowledge for the development of basic intelligent systems.
- develop an application using various soft computing algorithms.
- solve various real world problems using neural Fuzzy tools and technologies.

| CSBY03 | MOBILE COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To discuss about advanced learning in the field of wireless communication.
- To expose the students to the concepts of wireless devices and mobile computing.
- To provide a knowledge about various operating systems available currently for developing mobile computing applications.
- To discuss various issues related to security of mobile computing environment.

**PREREQUISITES:**

- Mobile Communication

**MODULE I MOBILE COMPUTING APPLICATIONS 5**

Overview – mobile business, mobile government, mobile life – Mobile computing applications supporting M- Business and M- Government – Platforms to support mobile computing applications.

**MODULE II OVERVIEW OF WIRELESS NETWORKS 7**

Classification – Standard bodies – IEEE 802.11, IETF – GSM – GPRS - Wireless security, architecture and management – Wireless business.

**MODULE III MOBILE COMPUTING PLATFORMS 8**

Introduction – Local platform services for mobile devices – Wireless middleware –Wireless gateways and mobile application servers – Wireless application protocol (WAP) – Toolkits for implementing wireless environment – Voice communication browsers – Case studies: OMAP, platform and middleware for wireless sensor networks.

**MODULE IV WIRELESS PERSONAL AREA NETWORKS 8**

Bluetooth – Ultra Wide Band (UWB) – Wireless Sensor Networks (Zigbee) – Generation of cellular networks (From 1G to 5G).

**MODULE V MOBILE COMPUTING APPLICATIONS 10**

Introduction – Key characteristics – Messaging for mobile users – Mobile commerce – Mobile portal – Mobile Customer Relationship Management - Mobile supply chain management – Special mobile applications – Mobile agent applications.

**MODULE VI SECURITY ISSUES IN MOBILE COMPUTING 7**

Introduction – Information security – Security techniques and algorithms – Security protocols – Public key infra structure – Trust – Security models – Security framework for mobile environment.

**Total Hours: 45**

**REFERENCES:**

1. Amjad Umar. "Mobile Computing and Wireless Communications", 2nd Edition, Age solutions, Inc, 2004.
2. Asoke K Talukder, Hasan Hasan Ahmed and Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd Edition, McGraw-Hill Communications Engineering, 2011.
3. Jelena Misic, Vojislav Misic, "Wireless Personal Area Networks: Performance, Interconnection and Security with IEEE 802.15.4", 1st Edition, Wiley publications, 2008.

**OUTCOMES:**

Students who complete this course will be able to

- acquire capability to work with heterogeneous networks.
- apply the knowledge of various mobile operating systems like Android to develop mobile computing applications.
- develop mobile computing applications by analyzing their characteristics and requirements.
- identify the security algorithms to be used for mobile computing environment.

**CSBY26 DISTRIBUTED SYSTEMS L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To provide tools and techniques to model a distributed system principal models and to acquire knowledge on how to model a distributed system.
- To introduce the higher level abstractions such as distributed file systems and peer-to-peer networks.
- To highlight the important issues pertaining to distributed environments.

**PREREQUISITES:**

- Computer Networks
- Distributed Computing

**MODULE I INTRODUCTION TO DISTRIBUTED SYSTEMS 8**

Introduction – Examples of distributed systems–Challenges-System models-Architectural models-Fundamental models-Networking and internetworking-Types of network-Network principles-Internet protocols-Ethernet-Wi-Fi-Bluetooth-ATM.

**MODULE II DISTRIBUTED OBJECTS 8**

API for internet protocols-External data representation-Marshalling-Client server communication-Group communication-Communication between distributed objects – Remote procedure call-Events and notifications-Case study-Java RMI.

**MODULE III DISTRIBUTED FILE SYSTEMS 8**

File service architecture- Case study: Sun network file system – Andrew File system-Name services-Domain name system-Directory services-Case study of global name service-Peer-To-Peer systems.

**MODULE IV DISTRIBUTED TRANSACTIONS 7**

Transactions-Nested transactions-Locks-Optimistic concurrency control-Timestamp ordering-Comparison of methods for concurrency control in distributed transactions-Distributed deadlocks-Transaction recovery.

**MODULE V DISTRIBUTED MULTIMEDIA SYSTEMS 7**

Characteristics of multimedia data-Quality of service management-Resource management-stream adaptation-Case study-Web services-IDL for web services-XML security-Coordination of web services.

**MODULE VI DISTRIBUTED SHARED MEMORY 7**

Design and implementation issues-Sequential consistency and Ivy case study-Release consistency and Munin case study-Other consistency models-CORBA case study.

**Total Hours: 45**

**REFERENCES:**

1. George Coulouris, Jean Dollimore,Tim Kindberg, “Distributed Systems-concepts and Design”, 4th Edition, Pearson Education, 2011.
2. Coulouris, Dollimore, Kindberg and Blair “Distributed Systems: Concepts and Design”, 5th Edition, Addison-Wesley, 2012.

**OUTCOMES:**

Students who complete this course will be able to

- acquire the ability to apply knowledge of distributed concepts to design and develop a solution for a given distributed application.
- apply the concepts in the design of distributed application.
- model connection-oriented and connectionless communication in 2 tier Client Server architecture.
- differentiate between client centric and data centric consistency models and describe protocols for implementing consistency models and updating replicas in a Distributed System.

| CSBY04 | WEB TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To acquire knowledge on Core technologies that are needed for the web like HTML and XML.
- To facilitate how to build XML applications with DTD and style sheets that span multiple domains ranging from finance to vector graphics to genealogy for use with legacy browsers.
- To get the knowledge on developing web sites which are secure and dynamic in nature.

**PREREQUISITES:**

- Web Programming Languages

**MODULE I INTRODUCTION** **7**

HTML Common tags: List, Tables, images, forms, Frames - Cascading Style sheets - Introduction to Java Scripts - Objects in Java Script - Dynamic HTML with Java Script.

**MODULE II VBSCRIPT LANGUAGE ELEMENTS** **7**

Constants - Variables and Data Types - Mathematical Operations - Logical Operators - Looping and Decision Structures - VBScript Functions and Objects: Data Conversion Functions - Mathematical Functions - Data Formatting Functions -Text Manipulation Functions - Data and Time Functions - Built-in Objects.

**MODULE III ASP FUNDAMENTALS** **7**

Using Server – Side Includes- Learning the SSI Directives – Creating Modular ASP Code -Using the Request Object: Using Form Information - Using Query String Information – Using Server Variables - Using the Response Object: Create Output – Managing Output – Managing the Connection.

**MODULE IV USING COOKIES** **8**

Introduction to Cookies: Cookies and Your Browser – Creating a Cookie – Modifying and removing Cookies – Tracking Preferences with Cookies Using

the Application, Session and Server Objects: The application Object - The Session Object – The Server Object –Using the global as a file - Active Data Objects Essentials: Microsoft's Universal Data Access Strategy – The Connection Object – The Record set and Field Objects – The Command and Parameter Objects – Using the Errors Collection.

**MODULE V INTRODUCING XML 8**

XML: The Life of an XML documents - Related technologies- First XML Document: Hello XML – Exploring the Simple XML Document – Assigning Meaning to XML Tags – Writing a Style Sheet for an XML Document – Attaching a Style Sheet to an XML Document – Style Languages: CSS Style Sheets, CSS Layouts, CSS Text Styles.

**MODULE VI ATTRIBUTES, EMPTY TAGS & XSL 8**

Attributes – Attributes versus Elements – Empty Elements and Empty Element Tags – XSL-DTDs and Validity: Document Type Definitions - Element Declarations – DTD Files – Document Type Declarations – Validating Against a DTD-Element Declaration - Entity Declarations: What Is an Entity – Internal General Entities – External General Entities – Internal Parameter Entities – External Parameter Entities – Building a Document from Places-Attribute Declaration: What is an Attribute – Declaring Attributes in DTDs - Declaring Multiple Attributes – Specifying Default Values for Attributes – Attribute Types – Predefined Attributes – A DTD for Attribute- Based Baseball Statistics.

**Total Hours: 45**

**REFERENCES:**

1. Dave Mercer, "ASP 3.0 Beginners Guide", Tata McGraw-Hill Edition, Sixth reprint, 2004.

2. Rajkamal, "Web Technology", 1st Edition, Tata McGraw - Hill, 2001.

**OUTCOMES:**

Students who complete this course will be able to

- utilize entry-level system analysis and design principles to solve business problems.
- analyze and create a web page and identify its elements and attributes.
- create XML documents and XML Schema.
- build and consume web services.

| CSBY05 | XML AND WEB SERVICES | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, CPA, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the basics of XML.
- To provide the background for web services.
- To explain the role of XML in web services.
- To examine the role of different technologies pertaining to web services.

**PREREQUISITES:**

- Web Programming Languages

**MODULE I WEB SERVICES** **6**

Introduction: SOAP WSDL UDDI – Origin of web services - Web Technology stack - Web services in reality - Limitations of web services.

**MODULE II XML FUNDAMENTALS** **9**

XML Fundamentals - XML Documents-XML namespaces Explicit and Default namespaces - Inheriting namespaces and not inheriting namespaces - Attributes and namespaces -XML Schema XML schema and namespaces - A first schema - Implementing XML schema types.

**MODULE III OVERVIEW OF SOAP** **7**

Overview of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments.

**MODULE IV UDDI** **8**

UDDI at a glance- The UDDI Business registry- UDDI under the covers – Accessing UDDI- How UDDI is playing out.

**MODULE V SEMANTICS AND META DATA** **6**

Role of semantics and meta data: Web 1.0, 2.0 and 3.0 - Types of semantics: Implicit, formal and Soft semantics - Application and Types of semantics - Models of semantics - Ontology and ontology development.

**MODULE VI SEMANTICS AND APPLICATIONS** **9**

Semantics for services: Nature of web services - Role of semantics in web services - Creation of Semantic meta data models and annotations – Example applications - Semantics for social data: Nature of social data -Role of semantics - Creation of semantic meta data models and annotations - Semantics for cloud computing.

**Total Hours: 45**

**TEXT BOOKS:**

1. Glenn Hostetler, Sandor Hasznos and Christine Heron, “Web Service and SOA Technologies, Practicing Safe Techs”, 1st Edition, Practicing Safe Techs publishers, 2009.

2. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services”, 1st Edition, Pearson Education, 2004.

3. Amit Sheth and Krishnaprasad Thirunarayanan, “Semantics Empowered Web 3.0: Managing Enterprise, Social, Sensor, and Cloud-based Data and Services for Advanced Applications”, 1st Edition, Morgan and Claypool publishing, 2012.

**REFERENCES:**

1. Frank. P. Coyle, “XML, Web Services and The Data Revolution”, 1st Edition, Pearson Education, 2002.

2. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, “Developing Java Web Services”, Wiley Publishing Inc., 2004.

**OUTCOMES:**

Students who complete this course will be able to

- write an XML Document along with DTD and XSD.
- design applications based on web services using XML.
- identify appropriate technology for web services based application.

| CSBY06 | MULTIMEDIA SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE,CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce principles and current technologies in multimedia systems.
- To explain multimedia concepts such as color theory and compression schemes.
- To describe the ways of processing multimedia information.
- To introduce the multimedia Quality of Service (QoS).

**PREREQUISITES:**

- Computer graphics and Multimedia

**MODULE I INTRODUCTION TO MULTIMEDIA 8**

Introduction: Multimedia – Historical Perspective – Multimedia Data and Multimedia Systems – The Multimedia Revolution – Digital Data Acquisition: Analog and digital Signals – Signals and Systems – Sampling Theorem and Aliasing – Filtering – Fourier Theory. Media Representation and Media Formats: Digital Images – Digital Video – Digital Audio – Graphics.

**MODULE II COLOR THEORY AND MULTIMEDIA AUTHORING 7**

The Color Problem – Trichromaticity Theory – Color Calibration – Color Spaces – Gamma Correction and Monitor Calibration – Multimedia Authoring: Requirements for Multimedia Authoring Tools – Intramedia Processing – Intermedia Processing – Multimedia Authoring Paradigms and User Interfaces – Role of User Interfaces – Device Independent Content Authoring – Multimedia Services and Content Management – Asset Management.

**MODULE III MULTIMEDIA COMPRESSION: VIDEO 8**

Need for Compression – A Taxonomy of Compression – Lossless compression – Lossy Compression – Media Compression Images: Redundancy and Relevancy of Image Data – Classes of Image Compression Techniques – Lossless Image Coding – Transform Image Coding – Wavelet Based Coding – Fractal Image Coding – Transmission Issues in Compressed Images. Media Compression Video: General Theory of Video Compression – Types of

Predictions – Complexity of Motion Compensation – Video-Coding Standards – VBR Encoding, CBR Encoding, and Rate Control.

**MODULE IV MULTIMEDIA COMPRESSION: AUDIO-GRAPHICS 7**

Media Compression Audio: Audio-Compression Theory – Audio as a waveform – Audio Compression using Psychoacoustics – Model-Based Audio Compression – Audio Compression using Event Lists. Media Compression Graphics: 2D Graphics Objects – 3D Graphics Objects – Graphics Compression in Relation to Other Media Compression – Mesh Compression using Connectivity Encoding – Mesh Compression Using Polyhedral Simplification – Multi resolution Techniques – Wavelet Based Encoding – Progressive Encoding and Level of Detail.

**MODULE V MULTIMEDIA DISTRIBUTION 8**

Multimedia Networking: The OSI Architecture – LAN – Modes of Communication – Routing – Multimedia Traffic Control – Multimedia Networking Performance and Quality of Service – Multimedia Communication Standards and Protocols. Wireless Multimedia Networking: Basics of Wireless Communications – Wireless Generations and Protocols – WAP – QoS over Wireless Networks. Digital Rights Management: Watermarking Techniques – Encryption Techniques – Digital Rights Management in the media industry.

**MODULE VI MULTIMEDIA DATABASES AND FRAMEWORK 7**

Multimedia Databases and Querying: Multimedia Data versus Multimedia Content – Multimedia Metadata – Multimedia Systems and Databases – Standards for Metadata – User Interfaces and Browser Paradigms. Multimedia Framework: Need for Unified Framework – MPEG-21 Objectives – Digital Item Identification – Digital Item Adaptation – Digital Item Processing – Digital Rights Management in Digital Items.

**Total Hours: 45**

**REFERENCES:**

1. Parag Havaldar, Gerard Medioni, “Multimedia Systems – Algorithms, Standard and Industry Practices”, 1st Edition, Cengage Learning, July 2009.

2. Ralf Steinmetz, Klara Nahrstedt, “Multimedia systems”, 1st Edition, Springer Verlag, 2004.

**OUTCOMES:**

Students who complete this course will be able to

- identify different multimedia data types and multimedia databases.
- apply various multimedia standards and authoring techniques for application development.
- use multimedia compression techniques for real time applications.

| CSBY27 | SOFTWARE AGENTS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the concepts, techniques and applications of software agents.
- To discuss some security issues.
- To understand the functions of intelligent software agents.

**PREREQUISITES:**

- Object Oriented Software Engineering

**MODULE I AGENTS - OVERVIEW** **8**

Agent definition - Agent programming paradigms - Agent Vs Object - Aglet - Mobile agents - Agent frameworks - Agent reasoning.

**MODULE II JAVA AGENTS** **8**

Processes - Threads - Daemons - Components - Java Beans - ActiveX - sockets - RPCs - Distributed computing - Aglets programming - Jini architecture - Actors and Agents - Typed and proactive messages.

**MODULE III MULTI AGENT SYSTEMS** **8**

Interaction between agents - Reactive agents - Cognitive agents - Interaction protocols - Agent coordination - Agent negotiation - Agent cooperation - Agent organization - Self-interested agents in Electronic commerce applications.

**MODULE IV INTELLIGENT SOFTWARE AGENTS** **7**

Interface agents - Agent communication languages - Agent knowledge representation - Agent adaptability - Belief desire intension - Mobile agent applications.

**MODULE V AGENTS AND SECURITY** **7**

Agent security issues - Mobile agents security - Protecting agents against malicious hosts - Untrusted agent - Black box security - Authentication for agents - Security issues for aglets.

**MODULE VI MARKET PLACE APPLICATION** **7**

Introduction – Facilitator Agent Buy Sell Message – Buyer Agent Seller Agent – Enhanced Buyers and Sellers- Market Place Application. – Agent Building and Learning Environment.

**Total Hours: 45**

**REFERENCES:**

1. Bigus & Bigus, "Constructing Intelligent agents with Java ", 1st Edition, Wiley, 1998.
2. Jeffrey M.Bradshaw, "Software Agents", 1st Edition, MIT Press, 2000.
3. Russel and Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education, 2003.
4. Richard Murch, Tony Johnson, "Intelligent Software Agents", Prentice Hall, 2000.
5. Gerhard Weiss, "Multi Agent Systems - A Modern approach to Distributed Artificial Intelligence", 2nd Edition, MIT Press, 2013.

**OUTCOMES:**

Students who complete this course will be able to

- summarize and remember the basic concepts of software agents.
- classify and categorize software agents.
- provide authentication for agents.
- apply agent communication languages for developing simple mobile agent applications.

| CSBY08 | EMBEDDED SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, NS)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide basic understanding about embedded systems.
- To understand the various building components of an embedded system.
- To give exposure to the embedded programming concepts and study the procedures for development and testing.

**PREREQUISITES:**

- Digital Signal Processing

**MODULE I INTRODUCTION TO EMBEDDED SYSTEMS 6**

Definitions – Embedded hardware components – Embedded Software – System on Chip (SoC) – VLSI Circuits – Fundamentals of Embedded System Design.

**MODULE II REAL-TIME OPERATING SYSTEMS 8**

Overview – Pseudo kernels to Operating Systems – Scheduling Fundamentals – System Services: Buffers - Mailboxes – Semaphores – Deadlock and Starvation Problems- Priority Inversion - Timer and Clock Services – Memory Management Issues.

**MODULE III DEVICES, COMMUNICATION BUSES AND PROTOCOLS 8**

I/O Devices – Device I/O Types and Examples – Synchronous Communication – ISO Synchronous Communication – Asynchronous Communication – Serial Bus Communication Protocols – Parallel Bus Communication Protocols– Wireless and Mobile System Protocols.

**MODULE IV EMBEDDED PROGRAMMING CONCEPTS 8**

Assembly Language Programming vs High Level Programming – Embedded C Programming Elements and Fundamentals – Object Oriented Programming for Embedded Systems – Cross Compliers – Memory Footprint optimization - Program Modeling Concepts

**MODULE V DEVELOPMENT AND TESTING 8**

Embedded Software Development Process - Development Tools – Hardware and Software Design Issues – Techniques and Tools for Testing, Simulation and Debugging - Design Examples and Case Studies of Program Modeling and Programming with RTOS.

**MODULE VI PERFORMANCE ANALYSIS OF EMBEDDED SYSTEMS 7**

Real Time Performance Analysis – Applications of Queuing Theory – Input/ Output Performance - Analysis of Memory Requirements – Metrics - Fault Tolerance – Inherent Uncertainly – Performance optimization Techniques.

**Total Hours: 45**

**REFERENCES:**

1. Phillip A. Laplante, Seppo J. Ovaska, “Real-Time Systems Design and Analysis: Tools for the Practitioner”, 4th Edition, Wiley-IEEE Press, 2011.
2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, 2nd Edition, McGraw-Hill Education, India, 2009.
3. Kai Qian, David Den Haring, Li Cao, “Embedded Software Development with C”, 1st Edition, Springer, 2009.

**OUTCOMES:**

Students who complete this course will be able to

- possess the basics of embedded system and its building blocks.
- design an embedded systems by applying the embedded programming concepts.
- analyze a real time scenario and trace its performance.

**CSBY28 IT SYSTEMS MANAGEMENT L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To focus on the importance of information systems management and their leadership issues
- To provide knowledge on the Technologies for developing and managing information resources and systems
- To Support Decision Making followed by the Challenges Ahead for rising societal risks of IT and messaging.

**PREREQUISITES:**

- Information Technology
- Management Information System

**MODULE I INTRODUCTION 5**

Importance of information systems management- History - The organizational environment - Technology environment - Mission of IS organizations – Model.

**MODULE II LEADERSHIP ISSUES 6**

ISO organization – CIO's responsibilities – Strategic uses of information technology – Information systems planning.

**MODULE III MANAGING THE ESSENTIAL TECHNOLOGIES 10**

Distributed systems – Overall architecture – Seven types of distributed systems - Defining the overall IT architecture – Importance of IT infrastructure – Managing telecommunications – Managing information resources – Managing operations- Case study.

**MODULE IV MANAGING SYSTEM DEVELOPMENT 9**

Technologies for developing systems – Management issues in system development – Case study.

**MODULE V SYSTEMS FOR SUPPORTING KNOWLEDGE BASED WORK 8**

Supporting Decision Making – Supporting Collaboration – Supporting Knowledge Work – Case study.

**MODULE VI THINKING AHEAD** **7**

The Challenges Ahead - Business continuity and disaster recovery – Problem management – Exception management.

**Total Hours: 45**

**REFERENCES:**

1. Barbara McNurlin, Ralph Sprague and Tung Bui," Information systems management in practice", 8th Edition, Prentice Hall, 2008.
2. Schiesser and Rich, "IT Systems Management", 2nd Edition, Prentice Hall of India, New Delhi, 2010.
3. Turban, Efraim, Rainer, R.Kelly, Potter and Richard E.," Introduction to Information Technology", 3rd Edition, John Wiley, 2005.

**OUTCOMES:**

Students who complete this course will be able to

- select and apply bullet-proof processes in areas ranging from change management to production acceptance, technology environment and information systems planning.
- use appropriate technology for managing operations and systems more efficiently and effectively.
- apply information resources to develop systems for supporting knowledge based work in business.

| CSBY10 | MOBILE AD HOC NETWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE,CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide a broad overview of the state of wireless and mobile ad hoc networking.
- To discuss physical, networking and architectural issues of mobile ad hoc networks.
- To elaborate the functions of various routing protocols under unicast, multicast and transport layer protocols.
- To give a knowledge about issues in QoS, energy management and security of ad hoc wireless networks.

**PREREQUISITES:**

- Computer Networks

**MODULE I INTRODUCTION** **9**

Introduction – Fundamentals of wireless communication technology – The Electromagnetic spectrum – Radio propagation mechanisms – Characteristics of the wireless channel – IEEE 802.11a,b standard – Origin of Ad hoc: Packet radio networks – Technical challenges – Architecture of PRNETs – Components of packet radios – Adhoc wireless networks – Heterogeneity in mobile devices – Wireless sensor networks – Traffic profiles – Types of Ad hoc mobile communications – Types of mobile host movements – Challenges facing Ad hoc mobile networks – Ad hoc wireless internet.

**MODULE II ROUTING PROTOCOLS** **8**

Introduction – Issues in designing a routing protocol for Ad hoc wireless networks – Classifications of routing protocols – Table-Driven routing protocols – Destination Sequenced Distance Vector (DSDV) – Source-Initiated On-Demand approaches – Ad hoc On-Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) –Location–Aided Routing (LAR) – Power-Aware Routing (PAR) – Zone Routing Protocol (ZRP).

**MODULE III MULTICASTING PROTOCOLS** **7**

Introduction – Issues in designing a multicast routing protocol – Operation of multicast routing protocols – An architecture reference model for multicast routing protocols –Classifications of multicast routing protocols – Tree-Based multicast routing protocols – Mesh-based multicast routing protocols – Summary of tree and mesh based protocols – Energy–efficient multicasting– Comparisons of multicast routing protocols.

**MODULE IV TRANSPORT LAYER PROTOCOLS** **7**

Introduction – Issues in designing a transport layer protocol for Ad hoc wireless networks – Design goals of a transport layer protocol for Ad hoc wireless networks –Classification of transport layer solutions – TCP over Ad hoc wireless networks – Other transport layer protocols for Ad Hoc wireless networks.

**MODULE V QOS AND ENERGY MANAGEMENT** **7**

Introduction – Issues and challenges in providing QoS in Ad hoc wireless networks –Classifications of QoS solutions – MAC layer solutions – Network layer solutions – QoS frameworks for Ad hoc wireless networks energy management in Ad hoc wireless networks –Introduction – Need for energy management in Ad hoc wireless networks – Classification of energy management schemes – Battery management schemes – Transmission power management schemes – System power management schemes.

**MODULE VI SECURITY PROTOCOLS** **7**

Security in Ad hoc wireless networks – Network security requirements – Issues and challenges in security provisioning – Network security attacks – Key management – Secure routing in Ad hoc wireless networks.

**Total Hours: 45**

**REFERENCES:**

1. C.Siva Ram Murthy and B.S. Manoj, ”Ad hoc Wireless Networks Architectures and Protocols”, 2nd Edition, Pearson Education, 2007.

2. Charles E. Perkins, “Ad hoc Networking”, 1st Edition, Addison Wesley, 2000.

3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile ad hoc networking”, 1st Edition, Wiley-IEEE press, 2004.

4. Mohammad Ilyas, “The handbook of Adhoc wireless networks”, 1st Edition, CRC press, 2002.

**OUTCOMES:**

Students who complete this course will be able to

- assess the platform architectures that are suitable for Mobile Adhoc networks.
- identify the issues in wireless networks and how they can be addressed.
- examine various security threats to ad hoc networks and propose solutions.

| CSBY11 | DATA WAREHOUSING AND DATA MINING | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide students with basic knowledge of tools and techniques for understanding the system performance and technologies for storing and mining large databases.
- To explain the computational tools and techniques for Data mining and Data Warehousing.

**PREREQUISITES:**

- DatabaseTechnology

**MODULE I DATA WAREHOUSING AND BUSINESS ANALYSIS 8**

Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools – Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

**MODULE II DATA MINING AND ASSOCIATION RULE MINING 7**

Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

**MODULE III CLASSIFICATION AND PREDICTION 8**

Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

**MODULE IV CLUSTER ANALYSIS** **7**

Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering HighDimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

**MODULE V MINING STREAMS, TIME SERIES AND SEQUENCE DATA** **7**

Mining Data Streams - Mining Time-Series Data - Mining Sequence Patterns in Transactional Databases - Mining Sequence Patterns in Biological Data - Graph Mining - Social Network Analysis and Multi relational Data Mining.

**MODULE VI APPLICATIONS** **8**

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web. Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

**Total Hours: 45**

**REFERENCES:**

1. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, 3rd Edition, Morgan Kaufmann Publishers, Elsevier, 2011.

2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, Pearson education, 2006.

**OUTCOMES:**

Students who complete this course will be able to

- distinguish between database and data warehouse, and design appropriate data warehouse multi dimensional model.
- perform basic data mining operations and apply standard data mining algorithms for association rule mining, clustering and classification and solve real time problems.

- correlate data mining techniques to current scenarios in various fields and inculcate the ability to apply tools for mining and analysis.
- review the various latest research activities going on in the field of Data Mining, thereby creating an interest for research.

**CSBY12 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS**

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

**(Common to M.Tech (CSE, SE))**

**OBJECTIVE:**

- To explain the different metric for measuring the performance of the system.
- To understand the importance of workloads and to predict the nature of future loads.
- To provide students with basic knowledge and understanding of queuing theory, petrinets and test beds.
- To train the students on the basics of simulation modeling.

**PREREQUISITES:**

- Probability and Queuing Theory

**MODULE I INTRODUCTION** **8**

Need for performance evaluation - Role of performance evaluation - Performance evaluation methods - Performance metrics and evaluation criteria - CPU and I/O architectures - Distributed and network architectures-Secondary storage - Topologies - Computer architecture - Fundamental concepts and performance measures.

**MODULE II PROBABILITY AND STOCHASTIC PROCESSES** **8**

Scheduling algorithms - Workloads - Random variables - Probability distributions - Densities - Expectation - Stochastic processes - Poisson process - Birth-Death process - Markov process.

**MODULE III QUEUING THEORY** **7**

Queuing systems - Networks of queues - Estimating parameters and distributions - Computational methods - Simulation process - Time control - Systems and modeling.

**MODULE IV PETRINETS AND SYSTEM PERFORMANCE** **8**

Petri nets - Classical Petri nets - Timed Petri nets - Priority-based Petri nets - Colored Petri nets - Generalized Petri nets - Tool selection - Validation of

results - Performance metrics -Evaluation - Multiple server computer system analysis.

**MODULE V ANALYSIS** **7**

OS components - System architecture - Workloads - Design – Simulation Analysis - Database system performance - Computer networks components - Simulation modeling of LAN.

**MODULE VI DISCRETE EVENT SIMULATION** **7**

Simulation - Simulation Techniques - Computing the Accuracy of Stochastic Simulations - Monte Carlo Simulation Random Number Generators - CDF Inversion.

**Total Hours: 45**

**REFERENCES :**

1. Paul J. Fortier and Howard E. Michael, “Computer Systems Performance Evaluation and Prediction", 1st Edition, Elsevier Science, USA, 2003.

2. Jean-Yves Le Boudec, “Performance Evaluation of Computer and Communication Systems”, 1st Edition, EPFL press, Lausanne, Switzerland, 2010.

**OUTCOMES:**

Students who complete this course will be able to

- carry out the performance analysis of their computer systems.
- categorize the different queuing models and algorithms for the analysis of networks.
- design a test bed and a simulator for a particular problem.

**CSBY13 AGENT BASED INTELLIGENT SYSTEMS L T P C**

**(Common to M.Tech (CSE, SE, CPA, CSE-BDA)) 3 0 0 3**

**OBJECTIVES:**

- To provide basic knowledge of employing intelligent agents in solving complex problems.
- To give the awareness of the building blocks of agents and working of different types of agents.
- To analyze the reasons for uncertainty and ability to design agents to handle them.

**PREREQUISITES:**

- Software Agents

**MODULE I INTRODUCTION 7**

Definitions – History – Hybrid Intelligent Agents – Agents vs Multi Agent Systems– Structure – Environment – Basic Problem Solving Agents – Complex Problem Solving Agents – Formulating Search Strategies – Intelligent Search.

**MODULE II CONCEPTS FOR BUILDING AGENTS 6**

Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events- Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle.

**MODULE III KNOWLEDGE BASED AGENTS 8**

Knowledge Representation – Logic – First Order Logic – Reflex Agent – Building a Knowledge Base – General Ontology – Interference – Logical Recovery.

**MODULE IV PLANNING AGENTS 8**

Situational Calculus – Representation of Planning – Partial Order Planning – Practical Planners– Conditional Planning - Preplanning Agents.

**MODULE V AGENTS AND UNCERTAINITY 8**

Acting under uncertainty – Probability – Baye's Rule – Belief Networks – Utility

Theory - Decision Network- Value of Information – Decision Theoretic Agent Design.

**MODULE VI HIGHER LEVEL AGENTS** **8**

Learning Agents – General Model – Inductive Learning – Learning Decision Tree – Reinforcement Learning – Knowledge in Learning – Communicative Agents – Types of Communicative Agents – Future of AI.

**Total Hours: 45**

**REFERENCES:**

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2010.
2. Lin Padgham, Michael Winikoff, “Developing Intelligent Agent Systems: A Practical Guide”, 1st Edition, John Wiley & Sons, 2004.
3. Zili Zhang,Chengqi Zhang, “Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving”, 1st Edition, Springer-Verlag New York, LLC , 2004.
4. Ngooc Thanh Nguyaaen, Lakhmi C. Jain, “Intelligent Agents in the Evolution of Web and Applications”, 4th Edition, Springer, 2009.

**OUTCOMES:**

Students who complete this course will be able to

- differentiate the types of agents and learn how to apply them in different problem based on requirements.
- design knowledge based agents for challenging environment.
- explore the scenarios of uncertainty and design planning agents to handle them.

| CSBY29 | PERSONAL SOFTWARE PROCESS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To explain how the estimating and planning skills can be improved.
- To discuss ways to measure the size, time, and defects in their work.
- To elaborate on the PSP quality strategy to manage the defects in the work and support the team's quality goals.

**PREREQUISITES:**

- Software Engineering

**MODULE I INTRODUCTION** **6**

Personal Process Strategy – Baseline Personal Process - Software Engineers Job.

**MODULE II TIME MANAGEMENT** **6**

Time Management - Tracking Time - Period and Product Planning – Product Planning.

**MODULE III ESTIMATION AND MANAGEMENT** **8**

Measuring Software Size – Software Estimating – Probe Estimating Model – Product size - Function points.

**MODULE IV MANAGING AND PLANNING** **8**

Managing your time – Managing commitments – Managing Schedules – Planning – Project Plan.

**MODULE V DEFECT HANDLING** **9**

Defects – Finding Defects – Code Review Checklist – Projecting Defects – Economics of Defect Removal – Design Defects.

**MODULE VI QUALITY** **8**

Product Quality – Process Quality – Personal Commitment to Quality – PSP Design Templates.

**Total Hours : 45**

**REFERENCES:**

1. Humphrey, Watts S. “Introduction to the Personal Software Process”, 2nd Edition, Pearson Education, 2009.
2. Humphrey, Watts S., “PSP: A Self - Improvement Process for Software Engineers”, 1st Edition, Boston, MA: Addison - Wesley, 2005.
3. Steve McConnell, “Code Complete: A Practical Handbook of Software Construction”, 2nd Edition, Microsoft Press, 2004.
4. Roger S Pressman, “Software Engineering: A Practitioner's Approach”, 6th Edition, Tata McGrawhill, 2005.

**OUTCOMES:**

Students who complete this course will be able to

- apply the time management skills in personal software development process.
- analyze and improve the quality of personal software development process.
- identify the various kinds of software defects in defect development life cycle.

**CSBY30 TEAM SOFTWARE PROCESS L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To provide a comprehensive introduction to term software development.
- To expose the students to realistic team work problems and give a practical teamwork experience.

**PREREQUISITES:**

- Software Engineering

**MODULE I INTRODUCTION 7**

TSP overview - TSP process - Logic of the TSP - Launching a Team project – SCM

**MODULE II THE MANAGER AND THE TEAM ROLES 8**

Team leader role - Development manager role - Planning manager role - Quality/ process manager role - support manager role.

**MODULE III STRATEGY AND PLANNING 8**

Development strategy - Development plan - Software inspections.

**MODULE IV DESIGNING AND DEVELOPMENT 7**

Defining the requirements – Designing with teams – Product implementation.

**MODULE V TESTING AND IMPLEMENTATION 7**

Product Implementation – Integration and System testing-Postmortem.

**MODULE VI MANAGING A TEAM 8**

Managing yourself- Being on a team – Teamwork- Case Study.

**Total Hours : 45**

**REFERENCES:**

1. Watts S Humphrey," Introduction to the Team Software Process", Boston MA: Addison – Wesley, 2008.

2. Roger S Pressman, "Software Engineering: A practitioner's Approach", 6th edition, R.S. Pressman and Associates, 2005.

**OUTCOMES:**

Students who complete this course will be able to

- explain role of team software process in programming.
- describe role of team manager in software development Apply principles of TSP for effective software development List the conflicts that undermine team work.

| CSBY31 | SOFTWARE ENGINEERING FOR IMAGE PROCESSING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To describe the use of object oriented programming for the implementation of image processing and analysis software.
- To get the knowledge of basic principles of object oriented analysis, design and programming.
- To discuss software engineering issues which are relevant for image processing.

**PREREQUISITES:**

- Software Engineering
- Image Processing

**MODULE I SOFTWARE ENGINEERING AND IMAGING SOFTWARE 6**

Introduction – A Case for a Software Engineering Approach to Building Imaging Systems – Classification of Software Qualities – Basic Software Engineering.

**MODULE II SOFTWARE PROCESS AND LIFE CYCLE MODELS 10**

Software Processes and Methodologies – Software Life Cycle Models – Software Standards – Software Requirements: Requirements Engineering Process – Types of Requirements – Requirements Users – Formal Methods in Software Specification – Specification of Imaging Systems: A Survey of Current Practices – Case Study– Object Oriented Analysis – Object– Oriented vs. Structured Analysis – Organizing the Requirements Document – Requirements Validation and Review.

**MODULE III SOFTWARE SYSTEM DESIGN 8**

The Design Activity – Procedural– Oriented Design– Object– Oriented Design – Hardware Considerations in Imaging System Design – Fault– Tolerant Design– The Software Production Process– Programming – Writing and Testing Code– Coding – Reviews and Audits– Documentation.

**MODULE IV SOFTWARE MEASUREMENT AND TESTING 5**

The Role of Metrics – Faults, Failures, and Bugs – The Role of Testing – Testing Techniques– Design of Testing Plans.

**MODULE V HARDWARE– SOFTWARE INTEGRATION 8**

Goals of System Integration – System Unification – System Verification – System Integration Tools – Software Integration– Post integration Software Optimization – A Software Reengineering Process Model – Software Reuse.

**MODULE VI MANAGEMENT OF SOFTWARE PROJECTS 8**

Concept– Software Project Management Themes – General Project Management Basics – Software Project Management – Managing and Mitigating Risks – Personnel Management – Assessment of Project Personnel– Tracking and Reporting Progress.

**Total Hours: 45**

**REFERENCES:**

1. Phillip A. Laplante, “Software Engineering For Image Processing Systems”, 2nd Edition, CRC Press, 2005.
2. Alejandro C Frery, Talita Perciano, “Introduction to Image Processing Using R”, 1st Edition, Springer, 2013.

**OUTCOMES:**

Students who complete this course will be able to

- become familiar with the basic principles of object oriented analysis, design and programming.
- apply various Image Processing Techniques in real world problems.
- solve interface problem when integrating various Multimedia objects.

| CSBY24 | SERVICE ORIENTED ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, NS, CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the fundamentals and issues relating to Service Oriented Architecture.
- To bring out the importance of service orientation and web services.
- To teach appropriate tools as technique on how to build the Service Oriented Architecture with web services.

**PREREQUISITES:**

- Web Technology
- Computer Networks

**MODULE I INTRODUCTION** **7**

Basic definition - Fundamentals of SOA - Characteristics and misperceptions about SOA -Benefits and pitfalls of SOA.

**MODULE II EVOLUTION OF SOA** **7**

The evolution of SOA - Web service and primitive SOA - The extension of SOA - Web service extension.

**MODULE III WEB SERVICE AND CONTEMPORARY SOA** **7**

Message Exchange Pattern - Service Activity – Coordination - Atomic Transaction - Business Activity- Orchestration – Choreography – Addressing - Reliable Messaging - Correlation and Policies - Meta data Exchange - Security-Notification and Eventing.

**MODULE IV PRINCIPLES OF SERVICE ORIENTATION** **8**

Principles of service orientation -Building SOA - Planning and Analysis - SOA delivery strategies - Service Oriented Analysis Introduction - Service Modeling of Service Oriented Analysis.

**MODULE V SERVICE ORIENTED DESIGN** **8**

Introduction to service oriented design - WSDL related XML Schema language

Basics - WSDL Language Basics - SOAP Language Basics - Service interface design tools - Steps to composing SOA - Consideration for choosing service layers, positioning core SOA standards and choosing SOA extension - Service design and business process design.

**MODULE VI WEB SERVICE EXTENSION AND SOA PLATFORM 8**

WS Addressing language Basics - WS Reliable Messaging language Basics- WS policy Language Basics - WS Metadata Exchange Language Basics-WS security Language Basics -SOA Platform basics - SOA Support in J2EE,SOA Support in .NET- Case Studies of Rail Co ltd and Oasis Car Wash service.

**Total Hours: 45**

**REFERENCES:**

1. Thomas Erl, “Service Oriented Architecture, Concepts, Technology and Design”, Pearson Education, 2009.

2. Shankar Kambhampaty, “Service Oriented Architecture for Enterprise Architecture for Enterprise Application”, 1st Edition, Wiley Publication, 2008.

**OUTCOMES:**

Students who complete this course will be able to

- relate web services with service oriented architecture.
- apply the tools and technique for Service Oriented Architecture.
- build an SOA platform supported by J2EE and .NET.

**CSBY32 PRINCIPLES OF GRID COMPUTING**

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

**OBJECTIVES:**

- To introduce necessary fundamentals that enable the students for advanced studies in the area of grid computing.
- To trace the evolution and progress of models of computation, from clusters to grid computing.

**PREREQUISITES:**

- Distributed Computing

**MODULE I INTRODUCTION** **8**

Basic Concepts - Entering into Grid - Definitions - Grid projects - Grid Layered Architecture - Distributed Computing - Computational Grids - Data Grids. Dynamic Virtual Organization – Distributed Shared Memory in Grid.

**MODULE II GRID COMPUTING TECHNOLOGIES** **8**

Service Oriented Architecture (SOA) - Web Services in Grid - Xml, Related Technologies and their role in Grid.

**MODULE III GRID PLATFORMS** **7**

Open Grid Service Architecture (OGSA) – OGSA Basic Services – Open Grid Services infrastructure (OGSI).

**MODULE IV GRID IMPLEMENTATIONS** **8**

Grid Computing Security – Globus Tool kit – Grid Technologies, Systems and Scheduling- Case study: Mobile Grid Computing.

**MODULE V GRID COMPUTING MODELS** **7**

Cluster Computing Models – Grid Models – Mobile grid Models – Applications.

**MODULE VI STIMULATED ALGORITHMS** **7**

Distributed Algorithms for Job Shop Scheduling - Parallel Stimulated Annealing algorithms- Case Studies.

**Total Hours: 45**

**REFERENCES:**

1. P.Venkata Krishna,M.Rajasekara babu,V Saritha, “Principles of Grid computing”, 1st Edition, Ane Books Pvt Lmt, 2010.
2. D.Janakiram, “Grid Computing Models”, 1st Edition, Tata McGraw-Hill Education, 2005.
3. Joshy Joseph, Craig Fellenstein, “Grid Computing”, 1st Edition, IBM Press, 2009.

**OUTCOMES:**

Students who complete this course will be able to

- apply the technologies such as high-speed links and storage area networks for building computational and data grids.
- utilize grid computing and cluster computing middleware, such as Globus Tool kits and HPC Portals for implementing virtual super computing resources.
- apply parallel and distributed computing algorithms in collaborated problem solving methodologies.
- apply the new ideas to solve open problems in distributed computing applications.

**CSBY33 PERVASIVE COMPUTING L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To give an insight knowledge about the principles of pervasive computing , its elements and architecture.
- To highlight the role of sensor networks, wireless protocols in the design of pervasive applications.

**PREREQUISITES:**

- Distributed Systems
- User Interface Design

**MODULE I ARCHITECTURE 8**

Relationship of Wireless Computing - Ubiquitous Computing - Internet Computing - Related Ideas: Ambient Computing - Elements of Pervasive architecture - Requirements of computational infrastructure - Failure management - General issues: security, performance, dependability - Web architectures - Local networks - Store and forward - Multi-network architectures.

**MODULE II DEVICES TECHNOLOGY 7**

Device and network technologies - Devices categories - Devices characteristic Heterogeneity and Interoperability - Mobile Agents - Device management - Compaq iPAQ - 3G devices - Palm Tungsten - WindowsCE devices - Symbian devices - J2ME-enabled devices.

**MODULE III SENSOR NETWORKS AND RFIDS 8**

Introduction to Sensor networks - Types of sensor networks - Berkeley Motes - Sensor network organization - Sensor network routing mechanisms - Platforms for Wireless sensor networks - Sensor Node Architecture - Sensor Network Architecture- RFID: Introduction, transponder and reader architecture- Types of tags and readers- Frequencies of operation- Selection criteria for RFID systems- Information processing in the transponder and reader- Fundamental Operating principles- Antennas for RFIDs.

**MODULE IV LOCAL AND WIDE AREA TECHNOLOGIES 8**

Local area wireless networks: IEEE 802.11 technologies - Mobile IP- Infrared technologies. Bluetooth networks (OBEX Protocol) - Messaging Systems - Personal Area Networks - Network Management - Quality of Service - Wireless protocols - Establishing Wide area wireless networks: Concept and structure of "cell"- Call establishment and maintenance - Channel management- Frequency Assignment techniques- Difference from a wired network.

**MODULE V PROTOCOLS 7**

Protocols: Networking protocols - Packet switched protocols - Routing Protocols for Sensor Networks - Data Centric Protocols - Hierarchical Protocols Location-based protocols - Multimedia Messaging Service (MMS) Protocols Wireless Application Protocol (WAP).

**MODULE VI APPLICATIONS 7**

Applications: Mobile access to patient information in a hospital, sales support, retailing- Services support, tracking applications - Designing for small screen devices - Search interfaces - Context- awareness - Determining "locality".

**Total Hours: 45**

**REFERENCES:**

1. Burkhardt, Henn, Hepper, Rintdorff, Schaeck. "Pervasive Computing", 6th Edition, Addison Wesley, 2009.

2. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schack, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", 1st Edition, Addison-Wesley, 2002.

**OUTCOMES:**

Students who complete this course will be able to

- differentiate pervasive computing from normal computing applications.
- explain the architecture of pervasive computing.
- describe how the devices (sensors and RFIDs) operate in a pervasive computing environment.
- identify the performance of various data dissemination techniques and compare the algorithms for mobile real-time applications.
- apply the basic techniques, algorithms, protocols of different types of networks for designing pervasive computing system.

**CSBY34 USER INTERFACE DESIGN L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To learn the prototyping and testing of user interfaces.
- To understand the importance of iterative design in producing usable software.
- Comprehend the techniques for evaluating the usability of an interface.

**PREREQUISITES:**

- Graphics and Multimedia

**MODULE I INTRODUCTION 7**

Human–Computer Interface – Characteristics of Graphics Interface – Direct Manipulation Graphical System – Web User Interface – Popularity – Characteristic & Principles.

**MODULE II HUMAN COMPUTER INTERACTION 7**

User Interface Design Process – Obstacles – Usability – Human Characteristics In Design – Human Interaction Speed – Business Functions – Requirement Analysis – Direct – Indirect Methods – Basic Business Functions– Design Standards – System Timings – Human Consideration In Screen Design.

**MODULE III STRUCTURES OF MENUS 7**

Functions of Menus– Contents of Menu – Formatting – Phrasing The Menu – Selecting Menu Choice – Navigating Menus – Graphical Menus.

**MODULE IV WINDOWS 8**

Characteristics – Components – Presentation Styles – Types – Managements– Organizations – Operations – Web Systems – Device – Based Controls Characteristics – Screen – Based Controls – Operate Control – Text Boxes– Selection Control – Combination Control – Custom Control – Presentation Control.

**MODULE V MULTIMEDIA 9**

Expansion of functions - Multi-resolution analysis - Scaling functions – MRA

refinement equation – Wavelet series expansion – Discrete Wavelet Transform (DWT) – Continuous Wavelet Transform – Fast Wavelet Transform – 2-D wavelet Transform – JPEG-2000 encoding – Digital Image Watermarking – Basics, SE, Erosion, Dilation, Opening, Closing – Hit-or-Miss Transform – Boundary Detection – Hole filling – Connected components, convex hull, thinning, thickening, skeletons, pruning – Geodesic Dilation – Erosion – Reconstruction by dilation and erosion.

**MODULE VI WINDOWS LAYOUT– TEST 7**

Prototypes – Kinds of Tests – Retest – Information Search – Visualization – Hypermedia – WWW– Software Tools.

**Total Hours: 45**

**REFERENCES:**

1. Wilbent. O. Galitz, "The Essential Guide To User Interface Design", 3rd Edition, John Willey & Sons Publication, 2007.
2. Ben Shneiderman, "Design the User Interface", 5th Edition, Pearson Education, 2009.

**OUTCOMES:**

Students who complete this course will be able to

- apply design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem.
- design a usable and compelling user-interface for given set of requirements.
- conduct an evaluation of a user-interface by employing a series of evaluation methods.

**CSBY35 SOFTWARE MAINTENANCE L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To describe the importance of software maintenance.
- To demonstrate the software maintenance processes and tools for maintenance
- To explain the normal and special practices for software maintenance.

**PREREQUISITES:**

- Software Engineering

**MODULE I INTRODUCTION 7**

Introduction - Issues in software maintenance - Body of knowledge – Definition - Difference between operations - development and Maintenance - standards, process and Activity – Categories - Maintenance Measurement - Service measurement and benchmarking – Maturity models in Software Engineering.

**MODULE II PROCESS MODEL AND MANAGEMENT DOMAIN 7**

Context of software Maintenance - Classification of software maintenance processes - Process domain and key process areas in software Maintenance– Goals – Links - Expected results and service definition - Training-Performance and Deployment of KPA.

**MODULE III MANAGEMENT AND EVOLUTION ENGINEERING DOMAIN 8**

Event Request Management KPA - Maintenance Planning KPA - Request Software Monitoring and Control KPA -SAM KPA - Pre delivery and Transition services KPA - Operational Support services KPA - Correction Services KPA - Verification and Validation KPA.

**MODULE IV ENGINEERING DOMAIN AND PROCESS MANAGEMENT 8**

Configuration and Version Management KPA - SQA KPA - MMA KPA - Casual Analysis and Problem Resolution - Software Rejuvenation - Migration and Retirement - Maintenance Process Focus - Service Definition – Training - Process Performance - Innovation and Deployment.

**MODULE V DETAILED EXEMPLARY PRACTICES 8**

Event Request Management KPA - Maintenance Planning KPA - Requests/ Software monitoring and Control KPA - SLA SAM KPA - Pre Delivery and Transition to software Maintenance - Operational Support services KPA - Software Evolution and Correction and services KPA - Verification and Validation KPA.

**MODULE VI SUPPORT AND CASE STUDIES 7**

Configuration and Change Management – Process - Service and Software Quality Assurance - Maintenance Measurement and Analysis - Casual Analysis and Problem Resolution - Evolution process and Support and Case Studies.

**Total Hours: 45**

**REFERENCES:**

1. Alain April, Alain Abrain, “Software Maintenance Management Evaluation and Continuous Improvement”, IEEE computer Society Publication, 2008.

2. Penny Grubb, Armstrong A .Takang, “Software Maintenance Concepts and Practice”, 3rd Edition, World Scientific Publishing Company, 2008.

**OUTCOMES:**

Students who complete this course will be able to

- formulate the maintenance procedures in routine maintenance.
- apply process models and software maintenance tools in Software maintenance.
- apply methods to solve software problems and analyze the case studies in Software maintenance.

**CSBY36 MULTIMODAL COMPUTING L T P C**

**3 0 0 3**

**OBJECTIVES:**

- To introduce the concept of multimodal systems and interfaces.
- To make them understand the importance of audio attention modeling and recognition.
- To give good rearing on the issues in the design and implementation of multimodal system.

**PREREQUISITES:**

- Programming Languages

**MODULE I INTRODUCTION TO MULTIMODAL SYSTEMS 9**

Introduction to Multimodal systems, Multimodal Interfaces: Unimodal - Multimedia interfaces - GUI. Interaction Modalities: Acoustic - Tactile - Visual - Basics of data acquisition: Audio - Video - Single microphone source separation - Admissibility of audio evidence - Acquisition of digital evidence.

**MODULE II AUDIO ATTENTION MODELLING AND DATA FUSION 9**

Audio attention modelling and data fusion: Types of attention - Measuring attention - Fusion of audiovisual attention – Multimodal integration and understanding: Early approaches - Unification multimodal integration and Parsing.

**MODULE III AUDIO RECOGNITION AND CLASSIFICATION 9**

Audio recognition and classification: Feature extraction - Hidden Markov Modelling - Training and pattern matching - Training and pattern matching. Audio enhancement techniques for forensics: Objectives of forensic analysis– Case study: Gaze recognition.

**MODULE IV ISSUES IN THE DESIGN AND IMPLEMENTATION 8**

Issues in the design and implementation of Multimodality: Multimodal user interface client - Modality recognition - Modality integration and understanding - Multimodal generation: Multimodal output planning - Multimodal synchronization - Multimodal Dialog management.

**MODULE V SECURITY AND SURVEILLANCE APPLICATIONS 5**

Security and surveillance applications: Requirements analysis - Challenges - Audio analysis as part of larger systems.

**MODULE VI HUMAN COMPUTER INTERACTION 5**

Audio-based human computer interaction: Audio scene analysis - Source localisation - Source separation - Performance analysis and comparison – Case Study involving Gesture recognition.

**Total Hours: 45**

**REFERENCES:**

1. Pradipta Biswas, Carlos Duarte, Patrick Langdon, Luis Almeida, Christoph Jung, “A Multimodal End-2-End Approach to Accessible Computing”,1st Edition, Springer 2013.
2. P. Maragos, A. Potamianos, P. Gros, “Multimodal Processing and Interaction: Audio, Video, Text”, Springer, 2010.
3. D. Wang, G. Brown, “Computational Auditory Scene Analysis: Principles, Algorithms, and Applications”, Wiley - IEEE Press, 2006.

**OUTCOMES:**

Students who complete this course will be able to

- identify the strengths and weaknesses of multimodal interfaces by proper comparison of different types.
- apply the human-computer interaction interfaces in employing new interaction techniques for restricted tasks.
- analyze and understand the various the security issues in the design and implementation of multimodal system tools.

| CSBY25 | CLOUD COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | (Common to M.Tech (CSE, SE, NS,CPA.CSE-BDA)) | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
- To provide an insight into the core of cloud computing that revolves around Internet architecture and virtualization.
- To expose the students to frontier areas of Cloud Computing and information systems.

**PREREQUISITES:**

- Distributed Operating System

**MODULE I SYSTEMS MODELING, CLUSTERING AND VIRTUALIZATION 8**

Scalable Computing Service over The Internet - Technologies for Network-based Computing - System Models for Distributed and Cloud Computing - Software Environments for Distributed Systems and Clouds - Performance, Security, and Energy-Efficiency - Clustering for Massive Parallelism - Computer Clusters and MPP Architectures - Design Principles of Computer Clusters - Cluster Job and Resource Management.

**MODULE II VIRTUALIZATION 7**

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

**MODULE III CLOUD FUNDAMENTALS 7**

Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models- Broadband Networks and Internet Architecture - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology.

**MODULE IV CLOUD COMPUTING ARCHITECTURE 8**

Fundamental Cloud Architectures - Workload Distribution Architecture -

Resource Pooling Architecture - Dynamic Scalability Architecture – Elastic Resource Capacity Architecture -Service Load Balancing Architecture - Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture.

**MODULE V ADVANCED CLOUD ARCHITECTURES 8**

Hypervisor Clustering Architecture – Load Balanced Virtual Server instances Architecture – Non-Disruptive service relocation Architecture – Zero Downtime Architecture- Cloud Balancing architecture – Resource reservation Architecture- Dynamic failure detection and recovery Architecture- Bare-Metal provisioning Architecture – Rapid Provisioning Architecture- Storage Workload Management Architecture.

**MODULE VI WORKING WITH CLOUDS 7**

Cloud Delivery Models: The Cloud Provider Perspective - Cloud Delivery Models: The Cloud Consumer - Cost Metrics and Pricing Models - Business Cost Metrics - Cloud Usage Cost Metrics - Cost Management Considerations.

**Total Hours: 45**

**REFERENCES:**

1. Kai Hwang, Jack Dongarra & Geoffrey Fox, “Distributed and Cloud Computing”, 1st Edition, Morgan Kaufmann, 2011.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, 2013.
3. Micheal Miller, “Cloud computing”, 1st Edition, Pearson, 2009.

**OUTCOMES:**

Students who complete this course will be able to

- Articulate the concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- Identify problems, explain, analyze and evaluate various cloud computing solutions.
- Demonstrate the various tools used in the cloud environment.
- Provide the appropriate cloud computing solutions according to the applications used.

**SSBY01 SOCIETY, TECHNOLOGY AND SUSTAINABILITY**

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

**OBJECTIVES:**

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

**PREREQUISITES:**

- Advanced Sciences

**MODULE I TECHNOLOGY AND ITS IMPACTS** **9**

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

**MODULE II TECHNOLOGY AND ITS ADVANCEMENT** **9**

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

**MODULE III SOCIETY AND TECHNOLOGY** **9**

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers Technological change and globalisation.

**MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 9**

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

**MODULE V THE IMPORTANCE OF SUSTAINABILITY 9**

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

**Total Hours : 45**

**REFERENCES:**

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, ‘Sustainability Science and Engineering: Defining Principles’, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

**OUTCOMES:**

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

- implement the benefits of modern technology for the well-being of human life.
- connect sustainability concepts and technology to the real world challenges.
- find pathway for sustainable society.