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. (Computer Science and Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide advanced knowledge and skills in the field of Computer Science and Engineering.
- To provide essential skill sets needed for Software Development as per the Industry requirements.
- To instill confidence and provide necessary ambience to take up fundamental as well as applied Research in Computer related domains with social relevance.
- To impart required analytical skills and tools for solving problems with varied complexity.
- To hone necessary skills to effectively communicate, work as a team for a successful professional career.

PROGRAMME OUTCOMES

On completion of the programme the graduates will

- have the capability to design and develop computer based systems for different domains.
- be able to apply the knowledge of computing tools and techniques for solving real life problems encountered in Software Industries.
- be able to pursue quality research in areas of social relevance.
- be able to work as a team exhibiting effective managerial skills.

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 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. (COMPUTER SCIENCE AND ENGINEERING) (FOUR SEMESTERS / FULL TIME) CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1	MAB6188	Mathematical Foundations of Computer Science	3	1	0	4
2	CSB6102	Computer Architecture	3	1	0	4
3	CSB6103	Data Structures and Analysis of Algorithms	3	0	2	4
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	CSB6105	Advanced Network Management Lab	0	0	3	1
8	CSB6106	Term Paper/Seminar	0	0	2	1
						25

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	CSB6211	Database Technology	3	0	0	3
2	CSB6212	Network Security	3	0	0	3
3	CSB6213	Distributed Operating Systems	3	0	0	3
4	CSB6214	Grid Computing	3	0	0	3
5		Elective II	3	0	0	3

6		Elective III	3	0	0	3
7	CSB6215	Distributed System Lab	0	0	3	1
8	CSB6216	Algorithmic Design and Implementation (Case study)	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	CSB7101	Project - Phase I	0	0	12	6*
						12

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	CSB7101	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) in IV Semester

TOTAL CREDITS : 81

LIST OF ELECTIVES

Sl. No	Course Code	Course
1	CSBY01	Theory of computation
2	CSBY02	Soft Computing
3	CSBY03	Mobile Computing
4	CSBY04	Web Technology
5	CSBY05	XML and Web Services
6	CSBY06	Multimedia Systems
7	CSBY07	Software Testing
8	CSBY08	Embedded Systems
9	CSBY09	Software Quality Assurance
10	CSBY10	Mobile Ad hoc Networks
11	CSBY11	Data warehousing and Data mining
12	CSBY12	Performance evaluation of Computer systems and Networks
13	CSBY13	Agent Based Intelligent Systems
14	CSBY14	Advanced Databases
15	CSBY15	Language Technology
16	CSBY16	Component Based Technology
17	CSBY17	Real Time Systems
18	CSBY18	Hacking Techniques & Digital Forensics
19	CSBY19	Network Processors
20	CSBY20	Multi-core Architecture
21	CSBY21	Digital Image Processing
22	CSBY22	Object Oriented Software Engineering
23	CSBY23	Advanced Operating Systems
24	CSBY24	Service Oriented Architecture
25	CSBY25	Cloud Computing
26	SSBY01	Society, Technology and Sustainability

27	CSBZ01	Data Science and Big Data Analytics
28	CSBZ02	Visualization Techniques
29	CSBZ03	High Performance Computing
30	CSBZ04	Green Computing

SEMESTER I

		L	T	P	C
MAB 6188	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (Common To M.Tech (CSE, CSE-BDA))**	**3**	**1**	**0**	**4**

OBJECTIVES:

- Students are to be motivated to address the challenge of the relevance of Inference Theory to Engineering problems, Algebraic Theory to Computer Science problems.
- Students will have an understanding of the Discrete Mathematical concepts and develop problem solving skills like solving recurrence relations using generating functions.
- Students are exposed to the concepts of Formal languages and Automata theory.

PREREQUISITES:

- Engineering Mathematics

MODULE I FUNDAMENTAL STRUCTURES **8**

Set theory: - Relationships between sets - Operations on sets - Set identities - Principle of inclusion and exclusion – Min sets Relations – Binary relations - Partial orderings - Equivalence relations. Functions:– Properties of functions - Composition of functions – Inverse functions - Permutation functions.

MODULE II LOGIC **8**

Prepositional, logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – Direct and indirect – Proof by contradiction – Mathematical Induction.

MODULE III COMBINATORICS **5**

Basics of counting – Counting arguments – Pigeonhole principle - Permutations and Combinations - Recursion and Recurrence relations – Generating functions.

MODULE IV ALGEBRAIC STRUCTURES 8

Introduction- Properties of an algebraic systems –Morphisms – Semi-groups– Monoids – Sub semi-groups and Submonoids –Groups-Order of a group – Order of an element-Permutation groups-Subgroups –Cyclic groups.

MODULE V MORPHISMS ON ALGEBRAIC STRUCTURES 8

Morphisms of groups – Kernel of homomorphism - Cosets and Lagrange's theorem – Normal sub groups – Rings and Fields.

MODULE VI MODELING COMPUTATION AND LANGUAGES 8

Finite state machines – Deterministic and Non- deterministic finite state machines – Turing Machines - Formal Languages – Classes of Grammars – Type_0 – Context Sensitive – Context – Free – Regular Grammars – Ambiguity.

L – 45; T – 15; Total Hours: 60

REFERENCES:

1. Judith L.Gersting, "Mathematical Structures for Computer Science", 5th Edition, W.H. Freeman and Company, NY, 2003.
2. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.
3. Rosen K.H., "Discrete Mathematics and its Applications", 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
4. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 3rd Edition, Pearson/ Addison Wesley, 2007.
5. Michael Sipser, "Introduction to Theory of Computation", 3rd Edition, Cengage Learning, 2012.

OUTCOME:

Students who complete this course will be able to

- apply the concepts of set theory, logic, combinatorics, groups and finite state machines in their courses.

CSB6102 COMPUTER ARCHITECTURE L T P C

(Common To M.Tech(CSE, IT, IS & DF, CSE-BDA)) 3 1 0 4

OBJECTIVES:

- to understand the functional requirement and various parameters that contribute to the performance of a computer system and the technology of achieving the best performance through these parameters.
- to acquire essential knowledge to measure or predict system performance.
- to understand the approaches in designing a new system through instruction level parallel processing and to improve the performance, overcoming the hazards - meeting the functionality.
- to understand how the memory hierarchy and optimization contribute to the performance of the system.
- to understand the data level parallel processing and vector processing for performance.
- to understand the concept of multi-processors and multi-core processors and performance through thread-level parallel processing.

PREREQUISITES:

- Microprocessor
- Basic computer architecture concepts.

MODULE I FUNDAMENTALS OF COMPUTER DESIGN 14

Measuring and reporting performance - Quantitative principles of computer design – functional requirements and architecture - Classifying instruction set architecture - Operands and operations for media and signal processing - Encoding an instruction set - Example architecture - MIPS and TM32.

MODULE II MEMORY HIERARCHY DESIGN 12

Memory Hierarchy - Cache performance - Reducing cache miss penalty and miss rate - Reducing hit time - Main memory and performance - Memory technology and optimization -Virtual memory and Virtual Machine and protection.

MODULE III INSTRUCTION LEVEL PARALLELISM 14

Pipelining and hazards - Concepts of ILP - Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: IP6 Micro architecture- Compiler techniques for exposing ILP - Static branch prediction - Static multiple issues: VLIW - Advanced compiler support -Hardware Vs Software speculation - Case study - IA 64 and Itanium processor.

MODULE IV DATA- LEVEL PARALLELISM 12

Vector architecture - SIMD instruction set extensions for multimedia – Graphic processing units – Detecting and enhancing loop level parallelism – Mobile Versus Server GPUs – Case studies.

MODULE V THREAD LEVEL PARALLELISM 8

Centralized Symmetric and shared memory multi-processor architectures - Performance issues – Distributed shared memory architecture – Directory based architecture – Synchronization – Cache Coherence and memory consultancy - Trends in processor design – Need for multi-core processor-difference between multiprocessor and multi core processor-Thread level processing-Simultaneous multithreading.

L-45; T-15; Total Hours: 60

REFERENCES:

1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th Edition, 2012.
2. D.Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.
3. Kai Hwang, "Advanced Computer Architecture Parallelism Scalability Programmability", Tata McGraw Hill, 2001.
4. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", 2nd Edition, Addison Wesley, 2004.
5. B.Govindarajalu,"Computer Architecture and Organization", 2nd Edition, Tata McGraw Hill Education Pvt.Ltd., 2010.

OUTCOMES:

Students who complete this course will be able to

- suggest instruction set, to meet the functional requirement and to contribute to performance.
- test the performance of a computer system.
- analyze changes in performance with various configurations and memory Hierarchy.
- analyze code for instruction level parallel processing and modify the code for out of order execution for better performance.
- modify the code to exploit SIMD architecture and improve the performance of the system.
- analyze how multi-threading in multiple processors and multi-core processors will share the resources for performance.

CSB6103	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS (Common to M.Tech (CSE, NS, CPA, CSE-BDA))	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To develop proficiency in the specification, representation, and implementation of Data Types and Data Structures.
- To carry out the Analysis Time and Space Complexity in different algorithms.
- To explain the applications of Data Structures for various scenarios.
- To relate data structures and algorithms with advanced computer science topics.

PREREQUISITES:

- Discrete Mathematics
- Programming languages

MODULE I INTRODUCTION **9**

The Need for Data Structures - Costs and Benefits - Abstract Data Types and Data Structures - Mathematical Preliminaries - Sets and Relations - Miscellaneous Notation - Logarithms -Summations and Recurrences - Recursion - Mathematical Proof Techniques - Direct Proof - Proof by Contradiction - Proof by Mathematical Induction – Algorithm Analysis – Best, Worst, and Average Cases - Asymptotic Analysis - Upper Bounds - Lower Bounds - Notation - Calculating the Running Time for a Program - Analyzing Problems - Empirical Analysis.

MODULE II ELEMENTARY DATA STRUCTURES **7**

List – Stacks – Queues – Binary Trees – Binary Search Trees – Huffman Coding Trees – Non – Binary Trees.

MODULE III SORTING AND SEARCHING **8**

Internal Sorting Techniques – Heap Sort – Quick sort – Merge Sort – Bin Sort and Radix Sort – Multi Way Merging - Time complexity Analysis of Sorting Techniques – Searching Unsorted and Sorted Arrays – Self – Organizing Lists – Hashing.

MODULE IV ADVANCED DATA STRUCTURES 7

Elementary Graph Algorithms – Minimum Spanning Tree – Single Source Shortest Path – All-Pairs shortest Path – Balanced Trees – AVL Trees- Red-Black Trees – Splay Trees – B-Trees – 1-2-3 Trees.

MODULE V ALGORITHMIC TECHNIQUES 7

Dynamic Programming – Greedy Algorithms – Number-Theoretic Algorithms – String Matching algorithms.

MODULE VI LIMITS TO COMPUTATION 7

Reductions - Hard Problems - The Theory of NP -Completeness – NP - Completeness Proofs - Coping with NP -Complete Problems - Impossible Problems – Uncountability.

L – 45; P – 15; Total Hours: 60

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition, PHI Learning, 2009.
2. Clifford A. Shaffer, “Data Structures and Algorithm Analysis in C++”, 3rd Edition, Dover Publications, 2011.
3. Mark Allen Weiss, “Data Structure and Algorithm Analysis in C++”, 3rd Edition, Prentice Hall, 2006.

OUTCOMES:

Students who complete this course will be able to

- design correct and efficient algorithm for common computational tasks.
- analyze and design existing algorithms and data structures.
- apply amortized analysis on data structures, including binary search trees, mergable heaps and disjoint sets.

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

OBJECTIVES:

- To make the students well versed in Data analysis.
- To describe the steps involved in research process.
- To explain 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.

CSB6105	ADVANCED NETWORK MANAGEMENT LAB	L	T	P	C
	(Common To M.Tech(CSE, CSE-BDA))	0	0	3	1

OBJECTIVES:

- To focus on understanding of fundamental concepts of modern computer network architecture (primarily the Internet) from a design perspective.
- To do systems/network programming and make use of simulation and measurement tools to gain an appreciation of current Internet.

PREREQUISITES:

- Computer Networks

LIST OF EXPERIMENTS

1. Analyzing physical layer properties (Band width, power).
2. Analyzing MAC Layer properties (IEEE 802.3, IEEE 802.4, IEEE 802.5, IEEE 802.11).
3. Analyzing various queuing models (FIFO, FAIR, RED).
4. Analyzing Routing layer protocol properties (Distance Vector, Link State).
5. Analyzing Transport Layer Protocol (TCP, UDP).
6. Analyzing Application Layer protocol (TELNET, FTP, Multimedia Applications).
7. Analyzing various security mechanisms.
8. Implementation of algorithms such as RSA, Diffie Hellman.
9. Analyzing wireless properties.
10. Comparison of performance of protocols in wired and wireless environments.
11. Mini project.

OUTCOMES:

Students who complete this course will be able to

- use the TCP/IP protocol suite and develop some simple applications.
- identify network related projects.
- design and implement a P2P file sharing application utilizing several application and transport layer protocols.

SEMESTER – II

CSB6211	**DATABASE TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To emphasize basic concepts of database management system, its functionalities and components.
- To describe the advantages of using a database environment for the management of data rather than conventional file structures.
- To outline the main activities and factors affecting performance when a DBMS is involved.

PREREQUISITES:

- Data structures

MODULE I DATABASE MANAGEMENT **8**

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

MODULE II TRANSACTION PROCESSING **7**

Heuristic optimization - Cost, size estimation - Models of transactions - Distributed transactions in Real world - Transaction processing in a centralized and distributed system - TP monitor.

MODULE III IMPLEMENTING ISOLATION **7**

Schedules - Objects and Semantic commutatively - Locking -Crash, abort and media failure - Recovery - Atomic termination - Distributed deadlock - Global serialization - Replicated databases.

MODULE IV DISTRIBUTED DATABASES **8**

Distributed databases Vs Conventional Databases – Architecture – Fragmentation - Query Processing – Concurrency Control – Recovery.

MODULE V OBJECT DATABASES **7**

Object databases - Conceptual object data model - XML and Web data - XML

schema - OLAP and Data mining - ROLAP and MOLAP – Graph based Data mining.

MODULE VI DATBASE DESIGN ISSUES 8

NOSQL- Very Large databases – Big Data- Optimization and research issues– Image Databases – Mobile databases - Text Databases.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

- design and model relational databases and retrieve data.
- design and apply object oriented and distributed database concepts in databases.
- develop data centric applications for Multimedia databases,mobile databases.

CSB6212	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a practical survey of both the principles and practice of cryptography and network security.
- To know the methods of conventional encryption, concepts of public key encryption and number theory.
- To gain knowledge on security in different layers of networks
- To acquire knowledge on wireless security

PREREQUISITES:

- Computer Networks

MODULE I INTRODUCTION` 6

Encryption, Decryption and Cryptosystems - Plain Text and Cipher Text - Encryption Algorithms - Cryptanalysis - Introduction to Ciphers-Mono alphabetic Substitutions such as the Caesar Cipher- Cryptanalysis of Mono alphabetic Ciphers – Poly alphabetic Ciphers such as Vigenere Tableaux – Cryptanalysis of Poly alphabetic Ciphers- Perfect Substitution Cipher such as the Vernam Cipher Stream and Block Ciphers - Characteristics of 'Good' Ciphers.

MODULE II SECURE ENCRYPTION SYSTEMS 8

Properties of Arithmetic Operations- Public Key (Asymmetric key) Encryption Systems- Hash Functions – Message Authentication Codes - Hash Algorithms- Secret Key (Symmetric Key) Encryption Systems.

MODULE III APPLIED CRYPTOGRAPHY, PROTOCOL AND PRACTICE 9

Key Management Protocols- Diffie-Hellman Algorithm- Key Exchange with Public Key Cryptography- Public Key Infrastructure (PKI)- Legal Issues.

MODULE IV OPERATING SYSTEM, DATABASE SECURITY 7

Operating Systems Security- Database Security- Security in networks

MODULE V NETWORK SECURITY **8**

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security –PGP- S/MIME- IP security– Web Security- Wireless Security.

MODULE VI SYSTEM LEVEL SECURITY **7**

Intrusion detection – Password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems – Case Study.

Total Hours : 45

REFERENCES:

1. William Stallings, “Cryptography and Network Security –Principles and Practice”, 5th Edition, Prentice-Hall, 2011.
2. Charles P. Pfleeger, “Security in Computing”, 4th Edition, Prentice-Hall International, 2006.
3. Christof Paar, Jan Pelzl & Bart Preneel, “Understanding Cryptography: A Textbook for Students and Practitioners”, 1st Edition, Springer, 2010.
4. Bruce Schneider, “Applied Cryptography Protocols, Algorithms, and Source Code in C”, 2nd Edition, John Wiley & Sons, 2007.

OUTCOMES:

Students who complete this course will be able to

- reproduce the principles of conventional and public key cryptography.
- compare and contrast encryption techniques like message authentication and hash functions.
- summarize security mechanism for different layers of network.

CSB6213 DISTRIBUTED OPERATING SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To explain the fundamental concepts, principles and state of- the-art practice underlying the design of distributed systems.
- To discuss the main concepts of shared memory, process management, distributed file systems of distributed operating system.
- To expose students to various computing principles and paradigms, including grid and Cluster computing used to build architectures to enhance distributed computing infrastructures.

PREREQUISITES:

- Advanced Operating System

MODULE I FUNDAMENTALS 8

Distributed computing - System model - Distributed operating system - Designing operating system - Introduction to DCE- Message Passing : Desirable features message passing system - Issues in message passing, synchronization, buffering, multi-datagram messages - Encoding and decoding of message data - Process addressing - Failure handling - Group communication.

MODULE II REMOTE PROCEDURE CALL 7

RPC model - Transparency of RPC- Implementing RPC mechanism - Stub generation -Marshaling arguments and Results - Server Management - Parameter-passing Semantics - Call Semantics -Communication protocols for RPCs - Complicated RPC Client server binding - Exception Handling – Security - Special types of RPCs - RPCs in Heterogeneous Environments - Lightweight RPC - Optimizations for better performance.

MODULE III DISTRIBUTED SHARED MEMORY 8

General architecture of DSM systems - Design and implementation of DSM – Granularity - Structure of shared memory space - Consistency models - Replacement Strategy- Thrashing - Other approaches to DSM - Heterogeneous DSM - Advantages of DSM - Synchronization: clock synchronization, event ordering, mutual exclusion – Deadlock - Election Algorithm.

MODULE IV RESOURCE AND PROCESS MANAGEMENT 7

Desirable Features of global Scheduling algorithm - Task assignment approach - Load balancing approach - Load sharing approach - Introduction to process management -Process migration - Threads.

MODULE V DISTRIBUTED FILE SYSTEMS 8

Introduction - Good features of DFS - File models - File Accessing models - File sharing Semantics - File-Caching Schemes - File Replication - Fault Tolerance - Atomic Transactions and design principles - Naming: Introduction - Desirable features of Naming system - Fundamental concepts - System oriented Names - Object locating mechanisms - Human oriented Names - Name Caches and Naming and Security.

MODULE VI EMERGING TRENDS 7

Emerging Trends in Distributed System - Concepts of Cluster and Concepts of Grid Computing - Grid Computing SOA: Basic SOA Definition - Overview of SOA - SOA and Web Services - Service Oriented Grid - SOA Design and Development - Advantages and Future of SOA Grid computing - Cloud and SOA.

Total Hours: 45

REFERENCES:

1. Andrew S. Tanenbaum and Maarten van Steen, “Distributed Systems: Principles and Paradigms”, 2nd Edition, Prentice Hall, 2007.
2. Puder, Romer, “Distributed Systems Architecture: Middleware approach”, 1st Edition, Elsevier Publication, 2005.
3. G. Coulouris, J. Dollimore and T. Kindberg, “Distributed Systems: Concepts and design”, 4th Edition, Addison-Wesley, 2005.

OUTCOMES:

Students who complete this course will be able to

- examine methods that have emerged from the field of distributed operating systems in an application perspective.
- identify research problems and challenges in distributed systems.
- implement new ideas to solve open problems in distributed systems.

CSB6214	GRID COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn the importance of Grid computing, Grid motivations and various research possibilities.
- To understand resource sharing capabilities in cluster computing, grid computing, supercomputing, and cloud computing
- To comprehend the technical capabilities and business benefits of Grid computing and learn how to measure those benefits via the Grid Economy.

PREREQUISITES:

- Distributed Computing

MODULE I GRID MOTIVATIONS **8**

Distributed Systems - Cluster Computing - Supercomputing - Cloud Computing - Data Intensive Computing - Storage Systems - Shared, Distributed and Parallel File Systems - Scientific Computing and Applications - Message Passing Interface (MPI) - Parallel Programming Systems and Models - Data-Intensive Computing with Databases - Multi - core computing era and new challenges.

MODULE II GRID COMPUTING **8**

Current Trends - Grid Computing - Evolution of the Grid computing - Examples of usage - Research possibilities - Scope in Grid Computing - Anatomy and Physiology of Grid- Web and Grid Services - Grid Standards - Challenges and applications.

MODULE III GRID MONITORING ARCHITECTURE **7**

Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems-RGMA -GridICE – MDS- Service Level Agreements (SLAs) - Other Monitoring Systems.

MODULE IV GRID SECURITY AND RESOURCE MANAGEMENT **8**

Introduction to Grid Security - PKI-X509 Certificates-Grid Security standards - Grid Scheduling and Resource Management - Gridbus Broker - principles of Local Schedulers - Grid Scheduling with QoS.

MODULE V GRID MIDDLEWARE **7**

Global Middlewares - Case Studies-Recent version of Globus Toolkit - Architecture, Components and Features - Next generation Grid.

MODULE VI DATA MANAGEMENT AND GRID ECONOMY **7**

Data Management in Grids - Data Management - Data Management Challenges-Architectural Approaches - Collective Data Management Services - Federation Services - Grid Portals - Generations of Grid Portals - Grid Simulation - Grid Applications - Grid economy – Computational economy.

Total Hours: 45

REFERENCES:

1. Joshy Joseph, Craig Fellenstein, “Grid Computing”, 1st Edition, IBM Press, 2009.
2. Srikumar Venugopal, Krishna Nadiminti, Hussein Gibbins and Rajkumar Buyya, “Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience”, Wiley Press, 2008.
3. Borja Sotomayor, Lisa Childers, “Globus Toolkit 4: Programming Java Services”, Elsevier, 2009.
4. Maozhen Li, Mark Baker, “The Grid: Core Technologies”, 1st Edition, Wiley, 2005.
5. Berman, Fran; Anthony J. G. Hey; Geoffrey C. Fox, Grid Computing: Making The Global Infrastructure a Reality. Wiley, 2003, ISBN: 978-0-470-85319-1

OUTCOMES:

Students who complete this course will be able to

- compare the strengths and limitations of grid computing.
- find appropriate solution to address the core issues of grid computing such as heterogeneity, security and interoperability.
- use grid computing middleware such as Globus Toolkit for accessing high end computational and data resources in a seamless manner.

CSB6215	DISTRIBUTED SYSTEM LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To implement concepts of Clock Synchronization, Client Server Communication and Dead lock in Distributed operating systems.
- To provide hands on experience on the concepts learned in their course.

PREREQUISITES:

- Computer Network

List of Experiments

1. Implementation of Election Algorithm.
2. Implementation of Deadlock
3. Java socket programming.
4. Client-server implementation using RPC/RMI.
5. Client server implementation using CORBA architecture.
6. Implementation of Clock synchronization.
7. Study of data centric & client centric consistency model.
8. Case study/implementation of DCOM.
9. Study project on Java Beans.
10. R.S. A. for Distributed System.
11. Study experiment on Network operating system and Distributed operating system with example.
12. Implementation name resolution.
13. Study/ implementation of Stateful Server and Stateless Server.

OUTCOMES:

Students who complete this course will be able to

- apply various algorithms like election algorithm, deadlock algorithm in distributed operating system.
- apply middle ware technologies in real applications.
- acquire the knowledge in distributed operating system through experiments study.

CSB6216 ALGORITHMIC DESIGN AND IMPLEMENTATION (CASE STUDY) **L T P C 0 0 3 1**

OBJECTIVES:

- To encourage problem solving, logical thinking and analytical capability.
- To analyze the algorithmic techniques applicable to real world problems.
- To critically explore the run time analysis of algorithms.
- To investigate principles and concepts related to algorithmic design.

PREREQUISITES:

- Design and Analysis of Algorithm

The students may select in any one of the following topics

1. Compare and analysis of any existing sorting algorithm (quick sort, radix sort, heap sort etc) with the modified sorting algorithms (modi_quick sort, modi_radix sort, modi_heap sort etc.).
2. Compare and analysis of any existing searching algorithm with the modified Searching algorithms.
3. Compare and analysis of the existing algorithms of Kruskal and Prim -Single-Source Shortest Paths with the improved Kruskal and Prim algorithm.
4. Compare and analysis of the existing algorithm of Bellman-Ford algorithms-Dijkstra's algorithm– All-pairs Shortest Paths with the improved Bellman-Ford algorithms and improved Dijkstra's algorithm.
5. Compare and analysis of any existing algorithm with modified algorithm in Data mining and data warehousing.
6. Compare and analysis of any existing algorithm with modified algorithm in Cryptography and security.

OUTCOMES:

Students who complete this course will be able to

- analyze algorithms and determine algorithm correctness.
- design and implement algorithms and techniques on real world problems.
- compare, contrast and summarize the ways others have approached the solution to the problem.
- master different data structures and algorithmic techniques.

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 to 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 Expressionse – 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 IN BUSINESS PRACTICES 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.

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 & 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.

CSBY07	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the relationship between testing and quality.
- To expose the students with different types and levels of testing.
- To gain knowledge on designing test cases based on the software application.

PREREQUISITES:

- Software Engineering

MODULE I INTRODUCTION **7**

Psychology of Testing – Economics of Testing – Causes of Software errors - Software Testing Principles – Software testing in V-Model, iterative-incremental Development models - Black Box Techniques – White Box Techniques.

MODULE II TEST ORGANIZATION **7**

Test Organization – Test Planning – Test Estimation – Test Strategy - Inspections and Walkthroughs – Code Inspections – An Error Checklist for Inspections – Walkthroughs – Desk Checking – Peer Ratings.

MODULE III TEST CASE DESIGN TECHNIQUES **8**

Black Box Techniques: Equivalence Partitioning – Boundary Value Analysis – Decision Table Testing – State Transition Testing – Use Case Testing. White-Box Techniques: Statement Testing and Coverage – Decision Testing and Coverage – Experience Based Techniques – Choosing Testing Techniques.

MODULE IV MODULE TESTING – HIGHER ORDER TESTING **8**

Test-Case Design – Incremental Testing – Top-Down Testing - Function Testing– System Testing – Acceptance Testing – Installation Testing – Regression Testing - Test Planning and Control – Test Completion Criteria – The Independent Test Agency - Usability Testing Basics and Process.

MODULE V DEBUGGING **7**

Debugging by Brute Force – Debugging by Induction – Debugging by

Deduction– Debugging by Backtracking – Debugging by Testing – Debugging Principles – Error Analysis.

MODULE VI TESTING IN AGILE ENVIRONMENT 8

Testing in Agile Environment: Features of Agile Environment – Agile Testing – Extreme Programming – Basic E-Commerce Applications – Testing Challenges and Strategies – Mobile Application Testing: Mobile Environment – Challenges and Approaches.

Total Hours: 45

REFERENCES:

1. Glenford J. Myers, Corey Sandler, “The Art of Software Testing”, 3rd Edition, Wiley, 2011.
2. Ron Patton, “Software Testing”, 2nd Edition, Sams Publishing, 2006.

OUTCOMES:

Students who complete this course will be able to

- carry out a code walkthrough for a program and find defects.
- design test cases for software applications.
- select the appropriate testing methodology to test the 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.

CSBY09 SOFTWARE QUALITY ASSURANCE L T P C

3 0 0 3

OBJECTIVES:

- To understand fundamental concepts of quality assurance, SQA activities and SQA metrics.
- To get an insight into the various quality control tools.
- To explore the guidelines prescribed by the various quality standards like CMMI.
- To investigate the techniques and tools for Software testing.

PREREQUISITES:

- Software Engineering

MODULE I CONCEPTS 8

Software Quality Challenge-Components of the Software Quality Assurance System-SQA system-an SQA architecture- Management and its role in software quality assurance-SQA unit and other actors in the SQA system-Quality Control Vs Quality Assurance ,Cost of Quality; QC tools - 7 QC Tools and Modern Tools; Business Process Re-engineering –Zero Defect, Quality Function Deployment, Benchmarking, Statistical process control.

MODULE II SOFTWARE QUALITY ASSURANCE FRAMEWORK 7

Concept of Software quality ,Quality Attributes, Software Quality Assurance, Components of Software Quality Assurance, Software Quality Assurance Plan, Steps to develop and implement a Software Quality Assurance Plan Quality Standards, ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma.

MODULE III SOFTWARE QUALITY ASSURANCE METRICS 7

Software Quality Metrics, Product Quality metrics, Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs, Software Quality metrics methodology, Establish quality requirements, Identify Software quality metrics, Implement the software quality metrics, analyze software metrics results, and validate the software quality metrics, Software quality indicators, Fundamentals in Measurement theory.

MODULE IV SOFTWARE TESTING **8**

Functional vs, Structural testing, Test planning and preparation, Test executions, Result Checking and measurement, Automation. Testing techniques: Adaptation, specialization and Integration, Case Study: Hierarchical web Testing. Process Improvement: Process Classification, Process Measurement, Process Analysis and Modeling Formal Verification Specification, Fault tolerance and failure containment.

MODULE V SOFTWARE QUALITY REFINEMENT **8.**

Software Process - Definition and implementation; internal Auditing and Assessments; Software testing -Concepts, Tools, Reviews, Inspections & Walk through; P-CMM.PSP and TSP, Methodology, Clean-room software engineering, Defect injection and prevention..

MODULE VI QUANTIFIABLE QUALITY IMPROVEMENT **7.**

QA monitoring and measurement, Analysis and follow up actions, Implementations, Integration and tool support, Models for Quality Assessment, Generalized and product specific models. Risk Identification for quantifiable quality improvement: Traditional statistical analysis techniques, new techniques for risk identification. Software Reliability Engineering: Reliability Analysis Using IDRMs (Input Domain Reliability Model) & SRGMs(Software Reliability Growth Model), TBRMs (Tree based reliability model) for reliability analysis and improvement..

Total Hours : 45.

REFERENCES:.

1. Chemuturi, Murali, “Best Practices, Tools and Techniques for Software Developers Data”, Ross Publishing, 2010.
2. Jeff Tian, “Software Quality Engineering: Testing, Quality Assurance, and Quantifiable”, Willey Publication, 2005.
3. Gordon G Schulmeyer, “Handbook Of Software Quality Assurance”, 3rd Edition, Artech House Publishers, 2009.
4. Roger Pressman, “Software Engineering", 6th Edition, McGraw Hill, 2005.
5. Daniel Galin, “Software Quality Assurance : From theory to implementation”, Pearson /Addison Wesley, 2004.

6. Stephen H.Kan, “Metrics and Models in Software Quality Engineering”, 2nd edition, Addison-Wesley Professional, 2003.

7. Alan C Gillies, “Software Quality - Theory and Management” , Third Edition, International Thomson Computer Press.

OUTCOMES:

Students who complete this course will be able to

- effectively apply software quality control tools.
- identify the software quality attributes and explore the quality standards.
- apply software testing techniques and identify the inputs and deliverables of testing.
- evaluate how new technologies impact software quality assurance and the system’s development life cycle.

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:

- Database Technology

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

L	T	P	C
3	0	0	3

OBJECTIVES:

- 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.
5. Jeffrey M.Bradshaw, "Software Agents ", MIT Press, 2000.

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.

CSBY14	ADVANCED DATABASES	L	T	P	C
	(Common to M.Tech (CSE, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To provide an insight into the practical and theoretical aspects of advanced topics in databases, such as object-relational databases and security issues.
- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To expose the main techniques for developing database systems.

PREREQUISITES:

- Database Management System

MODULE I DATABASE USERS AND ARCHITECTURE 8

Characteristics – Data model –Schemas – Instances - Three-Schema architecture – Data Independence – Centralized and client/Server Architecture– Relational model concept.

MODULE II BASIC SQL 7

SQL data definition and Data types – Specifying Constraints – Basic Retrieval Queries – INSERT, DELETE, and UPDATE Statements – Additional Features.

MODULE III RELATIONAL ALGEBRA AND CALCULUS 7

Unary Relational Operations: SELECT and PROJECT - Binary Relational Operations: JOIN and DIVISION – Tuple Relational Calculus – Domain Relational Calculus – Entity Types, Entity Sets, Attributes and Keys.

MODULE IV ENHANCED ENTITY-RELATIONSHIP MODEL 8

Subclasses, Super classes, and Inheritance – Specialization and Generalization - Data Abstraction, Knowledge Representation, and Ontology Concepts – Relational Database Design Using ER-to- Relational Mapping - Mapping EER model Constructs to Relations.

MODULE V SECURITY 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.

Total Hours: 45

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, 6th Edition, Pearson Education, 2010.
2. Philip M. Lewis, Arthur Bernstein and Michael Kifer, "Databases and Transaction Processing:An Application Oriented Approach", Addison Wesley, 2002.
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

- use 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.

CSYB15	LANGUAGE TECHONOLOGY	L	T	P	C
	(Common to M.Tech (CSE, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce the Natural Language Processing Methods.
- To educate information retrieval from search engines.
- To explain various statistical methods for natural language processing.

PREREQUISITES:

- Programming Languages

MODULE I INTRODUCTION **8**

Natural language processing – Linguistic background – Spoken language input and output technologies – Written language input – Mathematical methods – Statistical modeling and classification finite state methods grammar for natural language processing – Parsing – Semantic and logic Form – Ambiguity resolution – Semantic interpretation.

MODULE II INFORMATION RETRIEVAL **8**

Information retrieval architecture – Indexing – Storage – Compression techniques – Retrieval approaches – Evaluation – Search engines – Commercial search engine – Features – Comparison – Performance measures – Document processing – NLP based information retrieval – Information extraction.

MODULE III NATURAL PROCESSING **5**

Classical approaches to Natural Processing – Text processing – Lexical Analysis – Syntactic Parsing – Semantic Analysis – Natural Language Generation.

MODULE IV TEXT MINING **8**

Categorization – Extraction based categorization – Clustering – Hierarchical clustering- Document classification and Routing – Finding and organizing answers from text search – Use of categories and clusters for organizing retrieval results – Text categorization and efficient summarization using lexical chains – Pattern extraction.

MODULE V GENERIC ISSUES **8**

Multilinguality – Multilingual information retrieval and speech processing – Multimodality – Text and images – Modality integration – Transmission and storage – Speech coding – Evaluation of systems – Human factors and user acceptability.

MODULE VI APPLICATIONS **8**

Machine translation – Transfer metaphor – Inter lingual and statistical approaches – Discourse processing – Dialog conversational agents – Natural language generation – Surface realization and discourse planning.

Total Hours: 45

REFERENCES:

1. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition", CRC Press, 2010.
2. Daniel Jurafsky and James H.Martin, "Speech and Language Processing", 2nd Edition, Prentice Hall, 2008.
3. Michal W. Berry, Malu Castellanos "Survey Of Text Mining II: Clustering, Classification and Retrieval", 2nd Edition, Springer Verlag, 2008.

OUTCOMES:

Students who complete this course will be able to

- process and categorize the information retrieved from sources.
- solve practical problems in natural language processing using statistical techniques.
- handle generic issues in information retrieval and processing.

CSBY16 COMPONENT BASED TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To provide insight knowledge about the various fundamental properties of the components, technology, architecture and middleware.
- To recognize the use of various component based framework for a distributed environment.

PREREQUISITES:

- Service Oriented Architecture

MODULE I INTRODUCTION 8

Software components - Objects - Fundamental properties of component technology - MODULEs - Interfaces - Callbacks - Directory services – Component architecture -Components and middleware.

MODULE II JAVA COMPONENT TECHNOLOGIES 6

Threads - Java Beans - Events and connections - Properties - Introspection - JAR files - Reflection - Object serialization – RPC- Distributed object models - RMI and RMI-IIOP.

MODULE III ENTERPRISE JAVA BEANS 5

EJB - EJB Architecture - Overview of EJB software architecture - View of EJB -Conversation Building and deploying EJB - Roles in EJB.

MODULE IV CORBA TECHNOLOGIES 8

Java and CORBA - Interface definition language - Object request broker - System object model - Portable object adapter - CORBA services – CORBA component model - Containers - Application server - Model driven architecture.

MODULE V COM AND .NET TECHNOLOGIES 9

COM - Distributed COM - Object reuse - Interfaces and versioning – Dispatch interfaces - Connectable objects - OLE containers and servers - Active X controls- .NET components - Assemblies - App domains - Contexts – Reflection remoting.

MODULE VI COMPONENT FRAMEWORK AND DEVELOPMENT 9

Black box component framework - Directory objects - Cross-development environment- Component-Oriented programming - Component design and Implementation tools - Testing tools - Assembly tools.

Total Hours: 45

REFERENCES :

1. Gruntz, "Component Software: Beyond Object-Oriented Programming", 2nd Edition, Pearson Education publishers, 2011.
2. Tom Valesky, “Enterprise Java Beans”, 4th Edition, Pearson Education, 2008.
3. Ed Roman, "Enterprise Java Beans", 3rd Edition, Wiley publications, 2004.

OUTCOMES:

Students who complete this course will be able to

- realize and apply the principles for building software systems from component based techniques.
- explore Java, CORBA, .Net realization of components and implement for suitable applications.
- summarize the importance of OLE and component development.

CSBY17 REAL TIME SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To explain the basic concepts and specifications of Real Time System.
- To discuss the scheduling and resource allocation techniques of RTS.
- To elaborate on the issues and challenges involved in Real Time System design and development.

PREREQUISITES:

- Computer Architecture
- Operating System

MODULE I BASIC REAL TIME CONCEPTS 7

Basic component Architecture – Terminology- Real Time Design Issues – CPU-Memories - Input- Output - Other Devices Language Features - Survey of Commonly Used Programming Languages - Code Generation.

MODULE II REAL TIME SPECIFICATION AND DESIGN TECHNIQUES 9

Phases of software life cycle - Non-temporal Transition in the software life cycle - Spiral model, Natural languages - Mathematical Specification - Flow Charts - Structure Charts -Pseudo code and programmable Design Languages - Finite state Automata - Data Flow Diagrams – Petrinets - State-charts - Polled Loop Systems - Phase/State Driven Code - Co-routines - Interrupt Driven System- Foreground/Background Systems Full Featured Real Time OS.

MODULE III REAL TIME MEMORY MANAGEMENT 9

Buffering Data - Mail boxes Critical Region – Semaphores - Event Flags and Signals –Deadlock - Process Stack Management - Dynamic Allocation - Static Schemes - Response Time Calculation - Interrupt Latency- Time Loading and its Measurement - Scheduling Is NP Complete - Relocating Response Times And time Loading - Analysis of Memory Requirements - Reducing Memory Loading- I/O Performance.

MODULE IV QUEUING MODELS **5**

Basic Buffer size Calculation - Classical Queuing Theory- Little's Law – Faults - Failures, bugs and effects-Reliability-Testing.

MODULE V FAULT TOLERANCE, MULTIPROCESSING SYSTEMS **6**

Fault Tolerance - Classification of Architectures - Distributed Systems -Non Von-Neumann Architectures.

MODULE VI REAL TIME APPLICATIONS **9**

Goals of Real Time System Integration - Tools, Methodology - The Software Heisenberg Uncertainty Principle - Real Time Systems As Complex System-First Real Time Application Real Time Databases-Real time Image Processing Real Time UNIX - Building Real Time Applications with Real Time Programming Languages.

Total Hours: 45

REFERENCES:

1. Jane W.S.Liu, "Real Time System", 1st Edition, Pearson publication, 2001.
2. Phillip A. Laplante, "Real Time Systems Design and Analysis", 3rd Edition, John Wiley & Sons Inc., 2004.
3. Giorgio C. Buttazzo, "Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications", 3rd Edition, Springer, 2011.
4. Albert M. K. Cheng, "Real Time System: Scheduling, Analysis and Verification", 1st Edition, John Wiley & Sons Inc., 2002.

OUTCOMES:

Students who complete this course will be able to

- illustrate the various real time design principles and apply them.
- analyze the various challenges associated with real time system and the techniques to manage them.
- summarize the importance of memory management and fault tolerance.

CSBY18 HACKING TECHNIQUES AND DIGITAL FORENSICS L T P C

(Common to M.Tech (CSE, NS)) 3 0 0 3

OBJECTIVES:

- To educate upon the security threats.
- To understand the different vulnerabilities and modes of preventing them.
- To learn about security attacks and tools available to curtail them.

PREREQUISITES:

- Computer Security

MODULE I APPLICATION SECURITY 7

Problem factors- Defense mechanisms – Handling user access – User input – Handling attackers – Managing the application – Web application technologies – The HTTP protocol- Web functionality- Encoding schemes.

MODULE II AUTHENTICATION AND SESSION MANAGEMENT 7

Mapping the application - Bypassing client side control - Transmitting data via the Client - Capturing user data , HTML forms and thick-client components - Active X controls - Prevention - Attacking authentication - Design flaws in authentication - Implementation flaws in authentication - Prevention - Attacking session management - Weakness in session management generation and handling, Its prevention - Attacking access control.

MODULE III VULNERABILITIES AND PREVENTION 8

Common vulnerabilities, Its prevention - Code injection - Injection into SQL, OS commands, web scripting techniques, SOAP, XPath, SMDP, LDAP - Attacking path traversal - Finding and exploiting path traversal vulnerabilities, Its prevention - Attacking application logic - Logic flaws - Attacking other users - XSS - Redirection attacks - HTTP header injection - Frame injection- Request forgery- JSON hijacking - Session fixation - Local privacy attacks - Advanced exploiting techniques -Its prevention.

MODULE IV SECURITY ATTACKS 8

Burp proxy - Automating bespoke attacks - Uses for bespoke automation - Enumerating valid identifier - Fuzzing common vulnerabilities, Its prevention-

Exploiting information disclosure - Exploiting error message, Its prevention - Attacking compiled application - Buffered overflow attacks - Integer and format string vulnerabilities, Its prevention - Architectural attacks – Tiered architecture- Shared hosting and Application service providers, Its prevention - Server attack - Vulnerable application configuration and Software - Source code vulnerabilities - Different languages, Its prevention.

MODULE V HACKING AND SECURITY 7

Hacker's toolkit - Web browsers - Integrated testing suites – Vulnerability scanners -Nikto-hydra-custom Scripts - Hacker's methodology – Mapping application content -Analyzing application-testing - Client side controls - Authentication mechanism - Session management mechanism – Access controls - Input based vulnerabilities- Logic flaws- Sharing hosting vulnerabilities- Web server vulnerabilities- Miscellaneous checks.

MODULE VI TOOLS AND TECHNOLOGIES 8

Security tools and services - Time-based one-time passwords - Challenge/ response one-time password - Lamport's one-time password algorithm - Smart cards - RADIUS - SASI - Host-to-host authentication - PKI – Firewalls - Kinds of firewalls- Filtering services - Firewall engineering - Tunneling and VPNs - Secure communications over insecure networks - Kerberos authentication system - Link level encryption - Network level encryption - Application-level Encryption - Hidden markov model.

Total Hours: 45

REFERENCES:

1. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, Wiley Publications, 2011.

2. William R.Cheswick, Steven M. Bellovin and Aviel D.Rubin, "Firewalls and Internet Security – Repelling the Wily hacker", 2nd Edition, Pearson Education, 2008.

OUTCOMES:

Students who complete this course will be able to

- utilize the latest technology that are widely used by the digital forensic experts
- analyze on system vulnerabilities and provide solutions to overcome them.
- apply suitable tools and techniques for enforcing system security.

CSBY19	NETWORK PROCESSORS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To highlight different protocols and system architectures for packet processing.
- To expose students to network processor architectures and technology.
- To elaborate architecture details of commercially available network processor
- To discuss design issues in network processors

PREREQUISITES:

- Computer Networks

MODULE I INTRODUCTION **7**

Introduction and overview- Review of terminology and protocols – Conventional computer hardware and its use in low-end network systems- Algorithms for protocol processing, packet processing functionality – Software architectures for protocol processing on conventional hardware, advanced hardware architecture.

MODULE II TRADITIONAL PROTOCOL **7**

Traditional protocol processing systems- Network processing hardware – Basic Packet processing Algorithms and Data structures – Packet processing functions – Protocol Software- Hardware architectures for protocol processing –Classification and forwarding – Advanced hardware architectures.

MODULE III NETWORK PROCESSOR TECHNOLOGY **7**

Network Processors: Classification and forwarding: Motivation for network processors – Complexity of network processor design – Network processor architectures: Architectural variety, Architectural characteristics, Peripheral chips supporting network processors: Storage processors – Classification Processors – Search engines – Switch fabrics – Traffic Managers.

MODULE IV COMMERCIAL NETWORK PROCESSORS **8**

Scaling a network processor – begin a review of commercial network processor architectures – Multi-Chip pipeline – Augmented RISC processor – Embedded

processor plus coprocessors – Pipeline of heterogeneous processors – Extensive and diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design tradeoffs and consequences – classification languages.

MODULE V INTEL NETWORK PROCESSOR 8

Intel IXP 1200 network processor – Intel: reference platform embedded RISC processor – Intel programmable packet processor hardware and programming – Intel: more on programming the packet processors ACE Example- IXP Instruction set – Register formats- Micro engine programming – Developing sample application.

MODULE VI NETWORK PROCESSOR DESIGN AND IOS TECHNOLOGIES 8

Network processor design tradeoffs, next-generation chips – CISCO IOS – Connectivity and scalability – IP Routing – IP Services – IPV6- Mobile IP – MPLS – IP Multicast – Manageability – QoS – Switching – Layer 2 VPN2.

Total Hours: 45

REFERENCES:

1. D.E. Comer, “Network Systems Design: Using Network Processors: Intel IXP 2xxx Version”, 1st Edition, Pearson/Prentice Hall, 2005.
2. Comer D., “Network Systems Design Using Network Processors, Intel IXP1200 Version”, 1st Edition, Prentice Hall, 2003.
3. Ran Giladi,“Network Processors : Architecture, Programming and Implementation”, 1st Edition, Morgan Kaufman Publication, 2008.
4. Erik J.Johnson and Aaron R.Kunze, “IXP 1200 Programming: The Micro engine Coding Guide for the Intel IXP 1200 Network Processor Family”, 1st Edition, Intel Press, 2002.
5. Bill Carlson, “Intel@Internet Exchange Architecture & Applications a Practical Guide to Intel’s Network Processors”, 1st Edition, Intel Press, 2003.

OUTCOMES:

Students who complete this course will be able to

- analyze the design issues and network processor technologies.
- use the basic knowledge acquired on Network Processors.
- implement ethical, legal, security, and social issues related to computer networking.

CSBY20	MULTICORE ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To elucidate the basic concepts in multi-core programming.
- To study about how the coordination mechanism available on latest multi-core machines.
- To deonstrate the multi-core architectures and its use in effective concurrent program performance.

PREREQUISITES:

- Dual Core Processor

MODULE I INTRODUCTION TO MULTIPROCESSORS 9

Scalable design principles - Principles of processor design Parallelism, Thread level parallelism - Parallel computer models Instruction Level - Symmetric and distributed shared memory architectures - Performance Issues.

MODULE II MULTI CORE ARCHITECTURE AND SCALABILITY ISSUES 8

Multi-core Architectures – Software and hardware multithreading – SMT and CMP architectures -Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture.

MODULE III PARALLEL PROGRAMMING 7

Fundamental concepts – Designing for threads – scheduling - Threading and parallel programming constructs - Synchronization – Critical sections – Deadlock- Threading APIs.

MODULE IV OPENMP 8

OpenMP – Threading a loop – Thread overheads – Performance issues – Library functions - Solutions to parallel programming problems – Data races, deadlocks and live locks – Non-blocking algorithms – Memory and cache related issues.

MODULE V MPI **7**

MPI Model – Collective communication – Data decomposition – Communicators and topologies – Point-to-point communication – MPI Library.

MODULE VI MULTITHREADED APPLICATION **6**

Algorithms- Program development and performance tuning.

Total Hours: 45

REFERENCES :

1. Shameem Akhtar and Jason Roberts, “Multi-core Programming”, 2nd Edition, Intel Press, 2006.
2. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, 2nd Edition, Tata McGraw Hill, 2003.
3. John L. Hennessey and David A. Patterson, “Computer architecture – A quantitative approach”, 4th Edition, Morgan Kaufmann/Elsevier Publishers, 2007.
4. David E. Culler, Jaswinder Pal Singh, “Parallel computing architecture: A hardware/ software Approach”, 1st Edition, Morgan Kaufmann/Elsevier Publishers, 1998.

OUTCOMES:

Students who complete this course will be able to

- implement parallel programming system for Shared Memory architecture using Open MP libraries.
- use tools like V-tune Performance Analyzer, and Thread Checker.
- write the algorithms based on program development and tuning.

CSBY21	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give wide coverage of techniques and tools for digital image processing.
- To prepare students to develop on-hand experience in applying these tools to process the images.
- To provide engineering skills and intuitive understanding of the tools used in Image Processing.
- To introduce various image processing techniques.

PREREQUISITES:

- Digital Signal Processing

MODULE I INTRODUCTION **8**

Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.-Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

MODULE II IMAGE ENHANCEMENT TECHNIQUES **7**

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing – Sharpening filters – Homomorphic filtering.

MODULE III IMAGE RESTORATION **8**

Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering– Blind image restoration – Pseudo inverse – Singular value decomposition.

MODULE IV IMAGE COMPRESSION **7**

Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts.

DCT implementation using FFT, Run length coding, FAX compression, Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation.

MODULE V WAVELET BASED IMAGE COMPRESSION **8**

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 IMAGE SEGMENTATION AND REPRESENTATION **7**

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments– boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation.

Total Hours: 45

REFERENCES:

1. William K Pratt, “Digital Image Processing”, 4th Edition, John Willey Publication 2012.
2. O. Marques, Hoboken, “Practical image and video processing using MATLAB”, 1st Edition, Wiley, 2011.
3. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, 3rd Edition, Pearson Education, 2009.

OUTCOMES:

Students who complete this course will be able to

- apply the image fundamentals and mathematical transforms necessary for image processing.
- demonstrate image restoration procedures and the image compression procedures.
- implement the image segmentation and representation techniques.

CSBY22	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
	(Common to M.Tech (CSE, NS,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce concepts that underlies object orientation.
- To study about classical software engineering life cycle models.
- To discuss the implications of various aspects of object oriented software engineering.
- To learn techniques at each stage of development including use cases, UML.

PREREQUISITES:

- Data Structures
- Object Oriented Programming

MODULE I SOFTWARE ENGINEERING CONCEPTS 8

Software engineering concepts and development activities –Managing Software development - Software life cycle models – Iteration and Incrementation – Other life cycle models – Comparison of life cycle models.

MODULE II OBJECT ORIENTATION AND REQUIREMENT 8

Object Orientation Concepts - Requirement Elicitation Concepts – Activities– Negotiating Specifications with Clients – Maintaining Traceability – Documenting Requirements Elicitation.

MODULE III TEAM ORGANIZATION AND MODELLING WITH UML 7

Team Organization –Approaches – Choosing an appropriate Team Organization- People Capability Maturity Model Overview of UML – Modeling Concepts – A deeper view into UML.

MODULE IV ANALYSIS AND DESIGN 8

Overview of Analysis – Concepts – Activities – Managing Analysis – Design Concepts -From Modules to Objects - Cohesion- Coupling.

MODULE V TESTING 7

Testing Concepts – Testing Activities – Managing Testing – Object Oriented Testing Strategies – Challenges and issues.

MODULE VI MANAGING CHANGE AND CONFIGURATION 7

Rationale Management – Concepts – Activities – Documenting Rationale – Overview of Configuration Management.

Total Hours: 45

REFERENCES:

1. Stephen R.Schach “Object Oriented and Classical Software Engineering”, 8th Edition, McGraw Hill Education, 2010.
2. Bernd Bruegge & Allen H. Dutoit, “Object-Oriented Software Engineering Using UML, = Patterns, and Java”, 3rd Edition, Prentice Hall, 2010.
3. Timothy C. Lethbridge, Robert Laganiere, “Object-Oriented Software Engineering – Practical Software Development Using UML and Java.”, 2nd Edition, Mc-Graw Hill education, 2004.
4. Craig Larman “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd Edition, Prentice Hall, 2004.

OUTCOMES:

Students who complete this course will be able to

- Compare the different life cycle models and select the appropriate one for a project.
- Investigate principles of object oriented software engineering from requirements through testing.
- Illustrate the different UML diagrams using various tools..
- Identify the different artifacts produced during software development and develop the team skills required to build software applications.

CSBY23	ADVANCED OPERATING SYSTEMS	L	T	P	C
	(Common to M.Tech (CSE, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce advanced operating system concepts with emphasis on foundations & design principles
- To gain knowledge on various services provided by the operating systems
- To explain the architecture of multiprocessor operating systems
- To inculcate the knowledge of database operating systems

PREREQUISITES:

- Operating System

MODULE I INTRODUCTION **7**

Overview-Functions of an operating system- Design approaches-Types of Advanced operating system-Synchronization mechanism-Concept of a process-Concurrent processes-The critical section problem-Other synchronization problems-Language mechanisms for synchronization-Process dead lock-Preliminaries-Models of deadlocks.

MODULE II PROCESS AND MEMORY MANAGEMENT **8**

Process management-Process concepts threads-Scheduling-Criteria algorithms-Thread scheduling-Memory management: Swapping-contiguous memory allocation-Paging-Structure of the page table-Segmentation-Virtual memory-Demand paging-Page replacement-algorithms-Case study of windows.

MODULE III DEAD LOCK **8**

Principles of deadlock-system models-Deadlock characterization-Deadlock prevention-Detection and avoidance-Recovery form deadlock-I/O systems-Hardware-Application interface-Kernel I/O subsystem-Transforming I/O requests-Hardware operation-Streams-Performance.

MODULE IV MULTIPROCESSOR OPERATING SYSTEMS **8**

Basic multiprocessor system Architecture-Inter connection networks for multiprocessor systems-Caching-Hypercube architecture-Structures of

multiprocessor operating system-Operating systems design issues-Thread process synchronization and scheduling.

MODULE V DATA BASE OPERATING SYSTEMS 7

Introduction-Requirements of database operating systems-Concurrency controls-Theoretical aspects-Database systems-The problem of concurrency control-Serializability theory-Distributed database systems-Concurrency control algorithms-Lock based algorithms-Timestamp based algorithms.

MODULE VI FILE AND STORAGE 7

File system interface-The concept of a file-Access methods-Directory structure-File system mounting-File sharing-protection-File system implementation-Directory implementation-Allocation methods-Free space management-Efficiency and performance-Mass-Overview of mass storage structure-Disk structure-RAID structure.

Total Hours: 45

REFERENCES:

1. Abraham Silberschatz, Peter.B.Galvin, G.Gagne, “Operating system concepts”, 6th Edition, Addition Wesley publishing Co., 2003.
2. Pradeep K.Sinha, "Distributed operating system-Concepts and design", 5th Edition, PHI, 2003.
3. Andrew S.Tanenbaum, "Modern operating system", 3rd Edition, PHI, 2003.
4. Stallings, “Operating Systems’ – Internal and Design Principles”, 5th Edition, Pearson education/PHI, 2005.

OUTCOMES:

Students who complete this course will be able to

- analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files
- analyze the structure of operating systems and evaluate the relationship between the application programs that work on them.
- gain knowledge in database operating systems.

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:

- Computer Networks
- Web Technology

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.

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.

CSBZ01 DATA SCIENCE AND BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To deploy a structured lifecycle approach to data science and big data analytics projects.
- To use tools such as R and RStudio and Complex Event Processing tools.
- To get an understanding of the NoSQL databases Architecture, Storage and processing.
- To select visualization techniques and tools to analyze big data and create statistical models.
- To understand the security aspects of Big Data.

PREREQUISITES:

- Research Methodology

MODULE I INTRODUCTION **7**

Big Data Introduction – Evolution of Big Data - Importance of Big Data – Dealing with Big Data – Big Data and Business Case - Big Data in E-Commerce, IT, Social and Health Science - Building Big Data Team – Big Data Sources – Building a Big Data Platform – Structure to Unstructured Data – Processing Power.

MODULE II ANALYTICS AND STATISTICAL MODELING **7**

Overview of SQL and intro to R - Using R for Initial Analysis of the Data - Statistical Analysis with R and R Studio - Machine Learning Concepts: Regression, Classification, Pattern Recognition - MapReduce Framework.

MODULE III NoSQL DATABASES **8**

Storage Architecture – CRUD Operations – Querying NoSQL – Data Store Modification and Evolution Management – Data Set Ordering and Indexing – Transaction Management – Data Integrity - Using MySQL as NoSQL – Immutable Data Stores – Web Frameworks and NoSQL – Migrating from RDBMS to NoSQL.

MODULE IV DATA ANALYTICS **8**

Data Analytics - Data and Relations - Data Preprocessing - Data Visualization - Correlation -Regression - Forecasting - Classification – Clustering.

MODULE V COMMUNICATING RESULTS **7**

Visualization - Visual Data Analytics - Provenance – Privacy – Ethics - Governance.

MODULE VI SECURITY IN BIG DATA **8**

Security – Compliance – Auditing – Protection – Security and Privacy Aspects of Big Data- Infrastructure Requirements – Risk Management- Big Data environments for security.

Total Hours: 45

REFERENCES

1. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, IBM Corporation, 2012.
2. Bill Franks, Wiley and SAS Business Series, “Taming The Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 2012.
3. Tom White, “Hadoop: The Definitive Guide”, O’reilly, Third Edition, 2012.
4. Shashank Tiwari, “Professional NoSQL”, Wrox, 2011.
5. Runkler & Thomas. A, “Data Analytics- Models and Algorithms for Intelligent Data Analysis”, Springer Publishers, 2012.

OUTCOMES

Students who complete this course will be able to

- categorize and Summarize Big Data and its importance.
- manage Big Data and analyze Big Data.
- apply tools and techniques to analyze, visualize Big Data.

CSBZ02	VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge and practical experience with modern techniques of visualization.
- To get a practical experience of applying the visualization techniques in text, data and spatial domains.

PREREQUISITES:

- Research Methodology

MODULE I INTRODUCTION **6**

Visualization basics - History of Visualization - The Visualization Process - The Scatter plot - The Role of the User - Data Foundations - Types of Data - Data Preprocessing - Human Perception and Information Processing – Physiology - Perceptual Processing - Perception in Visualization - Metrics.

MODULE II VISUALIZATION FOUNDATIONS **9**

Semiology of Graphical Symbols - Visualization Techniques for Spatial Data - Visualization Techniques for Geospatial Data - Visualization of Point Data - Visualization of Line Data -Visualization of Area Data - Visualization for Information Retrieval.

MODULE III VISUALIZATION TECHNIQUES **9**

Visualization Techniques for Multivariate Data - Visualization Techniques for Trees – Graphs - and Networks - Text and Document Visualization - Levels of Text Representations - The Vector Space Model - Single Document Visualizations - Document Collection Visualizations - Extended Text Visualizations.

MODULE IV INTERACTION CONCEPTS **9**

Interaction Operators - Interaction Operands and Spaces - A Unified Framework - Interaction Techniques - Animating Transformations - Interaction Control - Designing Effective Visualizations - Steps in Designing Visualizations - Problems in Designing Effective Visualizations.

MODULE V CHARACTERISTICS OF VISUALIZATION **6**

User Tasks - User Characteristics - Data Characteristics - Visualization Characteristics - Structures for Evaluating Visualizations – Benchmarking

Procedures - Visualization Systems - Systems Based on Data Type - Systems Based on Analysis Type - Text Analysis and Visualization - Modern Integrated Visualization Systems – Toolkits.

MODULE VI CASE STUDIES **6**

Research Directions in Visualization - Issues of Data - Issues of Cognition - Perception and Reasoning - Issues of System Design - Issues of Evaluation - Issues of Hardware - Issues of Applications.

Total Hours: 45

REFERENCES:

1. Matthew Ward, Georges Grinstein, Daniel Keim," Interactive Data Visualization: Foundations, Techniques, and Applications", A K Peters/CRC Press, 2010.

2. Jin Zhang, "Visualization for Information Retrieval", Springer 2008.

OUTCOMES:

Students who complete this course will be able to

- trace the need for visualization.
- list the types of visualization models.
- apply the techniques of visualization for the appropriate applications .

CSBZ03	HIGH PERFORMANCE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the importance of High performance computing and various research possibilities.
- To provide in-depth knowledge of High performance computing concepts, design issues, challenges, technologies, architectures, and applications.
- To comprehend the technical capabilities and research benefits of High performance computing and learn how to measure and compare those benefits.

PREREQUISITES:

- Programming Languages

MODULE I PARALLEL PROCESSING CONCEPTS 8

Motivation - Applications - Challenges - Levels of parallelism - Instruction parallelism, transaction parallelism, task parallelism - Models : SIMD - MIMD, Dataflow Models, Demand-driven Computation - Architectures: N-wide superscalar architectures, multi-core architectures.

MODULE II DESIGN ISSUES IN PARALLEL COMPUTING 7

Synchronization - Scheduling - Job Allocation - Job Partitioning - Granularity and task dependency - Dependency Analysis - optimal code design - Mapping Parallel Algorithms onto Parallel Architectures - Performance Analysis of Parallel Algorithms.

MODULE III HPC CHALLENGES 8

Cache Coherence Problem - Invalidate vs. Update protocols - Bandwidth Limitations - Latency Limitations - Latency Hiding - Tolerating Techniques and their limitations.

MODULE IV HIGH PERFORMANCE COMPUTING IN THE CLOUD COMPUTING 7

Classification of scientific applications and services in the cloud – HPC Programming models - The Map Reduce programming model and Implementations.

MODULE V PERFORMANCE RELATED ISSUES 8

Cost criteria – Classical HPC and HPC in cloud environment – Performance criteria - comparisons –Supporting HPC in cloud.

MODULE VI HIGH PERFORMANCE COMPUTING APPLICATIONS 7

Cluster Computing – Supercomputing – High throughput computing - Computational Grid – computational economy – data intensive applications – Advanced scientific Computing and Applications – case studies.

Total Hours : 45

REFERENCES:

1. Rajkumar Buyya, “High Performance Cluster Computing: Architectures and Systems”, Volume 1, Pearson Edition, 2008.
2. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability” TataMcGraw Hill 1993.
3. G. Fox, M. Johnson, G. Lyzenga, S. Otto, J. Salmon and D. Walker, “Solving Problems on Concurrent Processors; General Techniques and Regular Problems”, Prentice Hall 1989.
4. Ian Foster, “Designing and Building Parallel Programs”, Addison Wesley 1995.
5. David Culler, Jaswinder Pal Singh, Anoop Gupta Parallel Computer Architecture: A hardware/Software Approach, Morgan Kaufmann, 1999.
6. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill, 2013.
7. George Hager & Gerhard Wellein “Introduction to High Performance Computing for Scientists and Engineers”, CRC Press, 2012.

OUTCOMES:

Students who complete this course will be able to

- examine the technologies and methods that have emerged from the field of High performance computing in an application perspective.
- identify the key challenges and research issues in High performance computing.
- solve various real world problems using HPC algorithms and Programming models.

CSBZ04	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make students understand and attain knowledge around

- the necessity of green computing technology.
- the issues with information technology and sustainability
- technologies for enabling green cloud computing.

PREREQUISITES:

- Operating System

MODULE I INTRODUCTION **8**

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Many Faces of Green—Environmental and Economic - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Energy-Efficient and Ecologically Friendly Data Centers.

MODULE II CONSUMPTION ISSUES **7**

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS **8**

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green.

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS **7**

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire

Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS - PHYSICAL, VIRTUAL, AND SOFTWARE 8

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity.

MODULE VI DATA STORAGE—DISK, TAPE, OPTICAL, AND MEMORY 7

Data Storage Trends, Challenges, and Issues - Addressing PCFE Storage Issues - Data Life Cycle and Access Patterns - Tiered Storage—Balancing Application Service with PCFE Requirements - Data and Storage Security - Data Footprint Reduction—Techniques and Best Practices -Countering Underutilized Storage Capacity - Storage Virtualization—Aggregate, Emulate, Migrate - Comparing Storage Energy Efficiency and Effectiveness – Benchmarking.

Total Hours : 45

REFERENCES:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, “Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line”, Mc-Graw Hill Education, 2008.
2. Greg Schulz, “The Green and Virtual Data Center”, CRC Press, 2009.
3. Marty Poniatowski, “Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center”, Printice Hall, 2009.
4. Kawahara, Takayuki, Mizuno, “Green Computing with Emerging Memory”, Springer Publications, 2012.
5. Ishfaq Ahmed & Sanjay Ranka, “Handbook of Energy Aware and Green Computing”, CRC Press,2013.

OUTCOMES:

Students who complete this course will be able to

- demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- select and critically evaluate technologies aimed to reduce energy consumption and the environmental impact of computing resources within a given scenario.
- address design issues needed to achieve an organizations' green computing objectives.