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) with Specialization in Big Data Analytics

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide advanced knowledge and skills in the field of Computer Science and Engineering.
- Capable to quickly adapt to new technology in the field of Big Data, assimilate new information, and solve real world problems.
- To pursue applied research in the advance field of computer science and be committed to life-long learning activities.

PROGRAMME OUTCOMES

On completion of the programme the graduates will

- be able to apply the knowledge of computing tools and techniques in the field of Big Data for solving real world problems encountered in the Software Industries.
- be able to analyze the various technologies & tools associated with Big Data.
- be able to identify the challenges in Big Data with respect to IT Industry and pursue quality research in this field with social relevance.

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

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

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

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 Project work 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	
		M.Sc. Biotechnology	
		M.Sc. Microbiology	
		M.Sc. Bioscience	

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.

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 REQUIREMENT AND SEMESTER / COURSE REPETITION

Attendance rules for all Full-time programme and Part-time – Day-time programmes are given in the following sub-clause.

11.1 A student should secure not less than 75% overall attendance in that semester taking into account the total no. of periods in all courses put together attended by the student as against the total no. of periods in all courses offered during that semester. If a student who could secure overall attendance between 65% and 75% only in a particular semester due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level sports events with prior permission from the Officials concerned shall be given exemption from the prescribed attendance requirement and he / she shall be permitted to appear for the current semester examinations.

The students who do not fulfill the above attendance requirement will not be permitted to write the semester end examination and will not be permitted to move to next semester. Such students should repeat all the courses of the semester in the next Academic year.

11.2 The faculty member of each course shall furnish the cumulative attendance details to the class advisor. The class advisor will consolidate and furnish the list of students who have earned less than 75% overall attendance, to the Dean (Academic Affairs) through the Head of the Department / School Dean. Thereupon, the Dean (Academic Affairs) shall issue orders preventing students from appearing for the semester end examination of all the courses of that semester.

11.3 A student who is awarded "U" 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 semester-end (re-do) examination. If any student obtained "U" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

11.4 If a student with "U" 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.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 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.

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

12.3 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.

12.4 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.

13.0 WEIGHTAGES

13.1 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%

13.2 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.

13.3 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.

14.0 SUBSTITUTE EXAMINATION

14.1 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.

14.2 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.

15.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

15.1 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	-
AB	-

Flexible range grading system will be adopted

“W” denotes withdrawal from the course.

"U" denotes unsuccessful performance in a course.

“AB” denotes absent for the semester end examination

15.2 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.

15.3 A course successfully completed cannot be repeated for any reason.

16.0 AWARD OF LETTER GRADE

16.1 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.

16.2 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).

17.0 DECLARATION OF RESULTS

17.1 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.

17.2 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.

17.3 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.

18.0 COURSE REPETITION AND ARREARS EXAMINATION

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

18.2 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.

18.3 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.

18.4 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.

18.5 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.

19.0 GRADE SHEET

19.1 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.

19.2 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 C_i 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.

'W' grade will be excluded for GPA calculations.

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

19.3 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 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.

20.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

20.1 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

20.2 The award of the degree must be approved by the University.

21.0 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
THEORY						
1	MAB6281	Statistics for Business Analytics	3	0	0	3
2	CSB6162	Data Mining and Data Analysis	3	0	2	4
3	CSB6163	Big data	3	0	0	3
4	CSB6274	Predictive Modeling	3	0	0	3
5		Elective II**	3	0	0	3
6		Elective III	3	0	0	3

PRACTICAL

1	CSB6220	Data Mining and Analysis Lab	0	0	3	1
2	CSB6221	Case Study : Big Data Analytics	1	0	2	1
						21

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	CSB7251	Project - Phase I #	0	0	12	6*
						12

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	CSB7251	Project - Phase II #	0	0	36	18*
						18 + 6 = 24

- Project must be done in the domain of Big Data.

** - Electives should be chosen from the CSE stream of electives.

TOTAL CREDITS : 82

LIST OF ELECTIVES

GROUP I - CSE STREAM

Sl. No.	Course Code	Course Title
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	CSBY10	Mobile Ad hoc Networks
8	CSBY13	Agent Based Intelligent Systems
9	CSBY14	Advanced Databases
10	CSBY15	Language Technology
11	CSBY22	Object Oriented Software Engineering
12	CSBY23	Advanced Operating Systems
13	CSBY24	Service Oriented Architecture
14	CSBY25	Cloud computing
15	SSB7181	Society, Technology and Sustainability

GROUP II - BIG DATA STREAM

1	CSBY94	Social Media Mining
2	CSB6271	Knowledge Discovery Technologies
3	CSB6272	Web Analytics
4	CSBY83	Cluster Analysis
5	CSBY84	Classification Methods and Evaluation
6	MAB6195	Multiple Linear Regression
7	CSBY85	Natural Language Processing
8	CSBY86	Market Analytics
9	CSBY87	Text Analytics
10	CSBY88	Precision Marketing
11	CSBY89	Complex Event Processes

12	CSBY90	Risk Analysis and Management
13	CSBY91	Intelligent Information Retrieval
14	CSBY92	Social Network Analysis & Mining
15	CSBY93	Data Visualization
16	CSBY79	Optimization Techniques
17	CSBY78	Machine Learning Techniques

SEMESTER I

MAB 6188	**MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE**	**L T P C** **3 1 0 4**

(Common To M.Tech(CSE, CSE-BDA))

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.

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:

The objective of the course is

- to understand the 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 to improve the performance, meeting the functionality.
- to understand how the memory hierarchy and optimization contribute to the performance of the system.

MODULE I FUNDAMENTALS OF COMPUTER DESIGN 14

Measuring and reporting performance - Quantitative principles of computer design - Classifying instruction set architecture - Memory addressing - Addressing modes - Type and size of operands - Operations in the instruction set - Operands and operations for media and signal processing - Instructions for control flow - Encoding an instruction set - Example architecture - MIPS and TM32.

MODULE II INSTRUCTION LEVEL PARALLELISM-HARDWARE APPROACHES 14

Pipelining and hazards - Concepts of ILP - Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: lP6 Micro architecture.

MODULE III INSTRUCTION LEVEL PARALLELISM-SOFTWARE APPROACHES 11

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 MEMORY HIERARCHY DESIGN 13

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

MODULE V MULTIPROCESSORS MULTI-CORE PROCESSORS 8

Symmetric and distributed shared memory architectures - Performance issues - Synchronization - Models of memory consistency.

Trends in processor design – Need for multi-core processor-difference between multiprocessor and multi core processor-Thread level processing-Simultaneous multithreading – Memory Hierarchy and Cache Coherency in multi-core processor.

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

REFERENCES:

1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach",4th Edition, Morgan Kaufmann / Elsevier , 2007.
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 methods of organization of various components of a computer system and instruction set, to meet the functional requirement and to contribute to performance.
- test the performance of a computer system.

- exploit instruction level parallel processing through software and improve the performance of the system.
- optimize the Memory Hierarchy and protection of memory.
- compare multi-processing and multi-core processing to optimize cost performance.

CSB6103	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	2	4

(Common to M.Tech (CSE, NS, CPA, CSE-BDA))

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.

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.

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.

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.
- complete simple problems on apply linear programming and transportation models.

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

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.

SEMESTER – II

MAB6281 STATISTICS FOR BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To identify the association between various types of data.
- To apply statistical inference techniques.
- To apply methods of inference to applied business situations.
- To identify, build and validate appropriate statistical regression models.

MODULE I INTRODUCTION **8**

Data -Data Tables - Categorical and Numerical Data - Recoding and Aggregation - Time Series - Describing Categorical Data - Charts of Categorical Data -The Area Principle - Mode and Median - Describing numerical data - Summaries of Numerical Variables -Histograms and the Distribution of - Numerical Data - Boxplot - Shape of a Distribution.

MODULE II ASSOCIATION IN CATEGORICAL AND NUMERICAL DATA **7**

Contingency Tables -Lurking Variables and Simpson's Paradox - Strength of Association - Scatterplots - Association in Scatterplots - Measuring Association - Summarizing Association with a Line - Spurious Correlation.

MODULE III PROBABILITY **8**

Probability - Conditional Probability - Random Variables - Association between Random Variables - Probability models for Counts - Normality - Managing Financial Risk -Modeling Sampling Variation.

MODULE IV INFERENCE **8**

Samples and Surveys - Sampling Variation and Quality - Confidence Intervals - Hypothesis Tests - Alternative Approaches to Inference - Data for Comparisons -Two-sample T-test - Confidence Interval for the Difference - Rare Events -Testing Association.

MODULE V REGRESSION MODELS - I **7**

Linear Patterns - Curved Patterns - Simple Regression - Regression Diagnostics - Multiple Regressions.

MODULE VI REGRESSION MODELS - II **7**

Building Regression Models - Categorical Explanatory Variables - Analysis of Variance - Time Series - Analyzing Experiments - Automated Regression Modeling.

Total Hours: 45

REFERENCES:

1. Robert Stine, Dean Foster, "Statistics for Business: Decision Making and Analysis", Pearson Education, 2nd edition, 2013.
2. Paul Newbold, William L. Carlson, Betty Thorne, "Statistics for Business and economics", Pearson Education, 6th edition.
3. Keller Gerald, "Statistics for Management and Economics", Cengage Learning, 1oth edition, 2014.

OUTCOMES:

Students who complete this course will be able to

- develop statistical models for business analytics
- use forecasting methods to support managerial, financial, and operational statistics.
- perform marketing analytics using statistical models.
- analyze customer data for customer acquisition, retention, and profitability.

CSB6162	DATA MINING AND DATA ANALYSIS (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 2 4

OBJECTIVES:

- To learn data analysis techniques.
- To understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.

MODULE I INTRODUCTION TO DATA MINING 7

Data mining-KDD versus data mining, Stages of the Data Mining Process-Task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages- Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning-Data transformation- Feature selection- Dimensionality reduction-Discretization and generating concept hierarchies-Mining frequent patterns-association-correlation.

MODULE II CLASSIFICATION AND CLUSTERING 7

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods- k-means- Hierarchical Methods – Distance based agglomerative and divisible clustering - Density-Based Methods – Expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

MODULE III DATA MINING SOFTWARE AND APPLICATIONS 7

Mining complex data objects - Spatial databases, temporal databases, Multimedia databases- Time series and Sequence data - Text Mining –Graph mining-Web mining-Application and trends in data mining.

MODULE IV PREDICTION OF QUANTITATIVE VARIABLES 7

Prediction of quantitative variables – Non Parametric estimation – Logical regression – Projection pursuit – Inferential aspects – Regression trees – Neural networks – Case studies.

MODULE V METHODS OF INTERNAL ANALYSIS 8

Methods of Internal analysis – Cluster analysis – Association among variables – Web mining analysis.

MODULE VI DATA ANALYTICS 9

Data Analytics – Simulated data – Mathematical statistic analysis – Applications of probability theory – Linear models – Case study.

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

REFERENCES:

1. Adelchi Azzalini, Bruno Scapa, “Data Analysis and Data mining”, 2nd Edition, Oxford University Press Inc., 2012.
2. Jiawei Han and Micheline Kamber, “Data Mining: Concepts and Techniques”, 3rd Edition, Morgan Kaufmann Publishers, 2011.
3. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, 10th Edition, TataMc Graw Hill Edition, 2007.
4. G. K. Gupta, “Introduction to Data Mining with Case Studies”, 1st Edition, Easter Economy Edition, PHI, 2006.

OUTCOMES:

Students who complete this course will be able to

- compare various conceptions of data mining as evidenced in both research and application.
- characterize the various kinds of patterns that can be discovered by association rule mining.
- evaluate mathematical methods underlying the effective application of data mining.

CSB6163	BIG DATA	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- This course brings together several key big data technologies used for storage, analysis and manipulation of data.
- To recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, and No-SQL.
- To prepare a sample project in Hadoop API.

MODULE I INTRODUCTION TO BIG DATA 7

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

MODULE II BIG DATA TECHNOLOGIES 8

Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics - Information Management.

MODULE III PROCESSING BIG DATA 7

Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

MODULE IV HADOOP MAPREDUCE 8

Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms -Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

MODULE V ADVANCED ANALYTICS PLATFORM 7

Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines – Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model.

MODULE VI BIG DATA TOOLS AND TECHNIQUES 8

Installing and Running Pig – Comparison with Databases – Pig Latin – User-Define Functions – Data Processing Operators – Installing and Running Hive – Hive QL – Tables – Querying Data – User-Defined Functions – Oracle Big Data.

Total Hours : 45

REFERENCES:

1. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
2. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, 1st Edition, IBM Corporation, 2012.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012.
4. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, O’reilly, 2012.

OUTCOMES:

Students who complete this course will be able to

- categorize and summarize Big Data and its importance.
- differentiate various Big data technologies like Hadoop MapReduce, Pig, Hive, Hbase and No-SQL.
- apply tools and techniques to analyze Big Data.

CSB6274	PREDICTIVE MODELLING	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES :

- To understand the terms and terminologies of predictive modeling.
- To study the various predictive models, their merits, demerits and application.
- To get exposure to various analytical tools available for predictive modeling.

MODULE I INTRODUCTION TO PREDICTIVE MODELING 8

Core ideas in data mining - Supervised and unsupervised learning - Classification vs Prediction -Steps in data mining- SEMMA Approach - Sampling -Pre-processing - Data cleaning - Data Partitioning - Building a model - Statistical models - Statistical models for predictive analytics.

MODULE II PREDICTIVE MODELING BASICS 8

Data splitting – Balancing- Overfitting –Oversampling –Multiple Regression - Artificial neural networks (MLP) - Variable importance- Profit/loss/prior probabilities - Model specification - Model selection - Multivariate Analysis.

MODULE III PREDICTIVE MODELS 9

Association Rules-Clustering Models –Decision Trees- Ruleset Models- K-Nearest Neighbors – Naive Bayes - Neural Network Model – Regression Models – Regression Trees – Classification & Regression Trees (CART) – Logistic Regression – Mulitple Linear Regression Scorecards –Support Vector Machines – Time Series Models - Comparison between models - Lift chart - Assessment of a single model.

MODULE IV PREDICTIVE MODELING MARKUP LANGUAGE 7

Introduction to PMML – PMML Converter - PMML Structure – Data Manipulation in PMML – PMML Modeling Techniques - Multiple Model Support – Model Verification.

MODULE V TOOLS AND TECHNOLOGIES 7

Weka – RapidMiner – IBM SPSS Statistics- IBM SPSS Modeler – SAS Enterprise Miner – Apache Mahout – R Programming Language.

MODULE VI CASE STUDIES **6**

Real time case study with modeling and analysis.

Total Hours: 45

REFERENCES:

1. Kattamuri S. Sarma, “Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications”, 2nd Edition, SAS Publishing, 2007.
2. Alex Guazzelli, Wen-Ching Lin, Tridivesh Jena, James Taylor, “PMML in Action Unleashing the Power of Open Standards for Data Mining and Predictive Analytics”, 2nd Edition, Create Space Independent Publishing Platform,2012.
3. Ian H. Witten, Eibe Frank , “Data Mining: Practical Machine Learning Tools and Techniques”, Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann, 3rd Edition, 2011.
4. Eric Siegel , “Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die”, 1st Edition, Wiley, 2013.
5. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.
6. Jeremy Howard, Margit Zwemer, Mike Loukides, “Designing Great Data Products- Inside the Drivetrain Approach, a Four-Step Process for Building Data Products – Ebook”, 1st Edition, O'Reilly Media, March 2012.

OUTCOMES:

Students who complete this course will be able to

- design and analyze appropriate predictive models.
- define the predictive models using PMML.
- apply statistical tools for analysis.

CSB6220	DATA MINING AND DATA ANALYSIS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To analyze the data using statistical methods.
- To understand and demonstrate data mining .

List of Experiments

1. Data Analysis- Getting to know the Data(Using ORANGE,WEKA)
    - Parametric - Means, T-Test, Correlation
    - Prediction for numerical outcomes - Linear regression
    - Correlation analysis
    - Preparing data for analysis
        - Pre-processing techniques
2. Data Mining (Using ORANGE,WEKA or any open source data mining tool)
    - Implement clustering algorithm
    - Implement classification using
        - Decision tree
        - Back propagation
    - Visualization methods.

OUTCOMES:

Students who complete this course will be able to

- use statistical techniques to carry out the analysis of data.
- gain hands-on skills and experience on data mining tools.

CSB6221	CASE STUDY: BIG DATA ANALYTICS	L	T	P	C
		1	0	2	1

OBJECTIVES:

- To provide an overview of several key technologies used in manipulating, storing, and analyzing big data.
- To understand the fundamentals of Hadoop.
- To apply the learning specific problems in various domains.

TOPICS

1. Big Data Tools and Technology [Learning and Demonstration of Big Data Ecosystem]
   - Hadoop
   - HBase
   - NoSQL
   - Hive
   - Pig
   - R

2. Big Data and R

- Introduction to R [Reading Exercise]
- Clustering
- Association rule mining
- Simple Linear Regression
- Decision Trees
- Naïve Bayesian Classification

3. Big Data Interactions [Literature Reviews and Case studies]

- Big Data and Cloud
- Big Data and Web Services /SOA
- Big Data and Internet of Things (IoT)
- Big Data and Complex Event Processing (CEP)

- Big Data - Security Considerations

4. Big Data Case Study :

- Healthcare Data
- Web Click stream Data
- Social Media Data [RSS, Tweets]
- Educational Data

Software: Oracle NoSQL Database; Oracle Big Data Connectors; Oracle R Enterprise ; R for Linux/Windows; R Studio; Hadoop

OUTCOMES:

Students who complete this course will be able to

- gain the knowledge of problems associated with big data in various domains.
- apply tools and techniques to analyze big data.

SEMESTER III

		L	T	P	C
CSB7201	**SOFTWARE PROJECT MANAGEMENT**				
	(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.

MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 8

Defining a project- Sequence of Activities – Complex Activities – A Business focused de?nition - 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 -Internet protocols-Ethernet-Wi-Fi-Bluetooth-ATM.

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.
- acquire the ability to track project execution.
- analyze the risks associated with the projects.

ELECTIVES

GROUP I CSE STREAM

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.

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 ε –Moves.

MODULE II REGULAR LANGUAGES 6

Regular Languages – Regular Expressions and regular Languages – Applications of Regular Expressions – Equivalence of Regular Expressions and NFA with ε -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

- complete simple problems on automata and grammar
- 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.

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.

MODULE I MOBILE COMPUTING APPLICATIONS AND PLATFORMS 5

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

MODULE II OVERVIEW OF WIRELESS NETWORKS 7

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

MODULE III MOBILE COMPUTING PLATFORMS 8

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

MODULE IV WIRELESS PERSONAL AREA NETWORKS 8

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

MODULE V MOBILE COMPUTING APPLICATIONS 10

Introduction – Key characteristics – Messaging for mobile users – Mobile commerce – Mobile portal – Mobile Customer Relationship Management -

Mobile supply chain management – Special mobile applications – Mobile agent applications.

MODULE VI SECURITY ISSUES IN MOBILE COMPUTING 7

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

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

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.

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 .asa 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.

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 to 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).

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.

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.

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.

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.

MODULE I INTRODUCTION 7

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

MODULE II CONCEPTS FOR BUILDING AGENTS 6

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

MODULE III KNOWLEDGE BASED AGENTS 8

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

MODULE IV PLANNING AGENTS 8

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

MODULE V AGENTS AND UNCERTAINITY 8

Acting under uncertainty – Probability – Baye's Rule – Belief Networks – Utility Theory - Decision Network- Value of Information – Decision Theoretic Agent Design.

MODULE VI HIGHER LEVEL AGENTS 8

Learning Agents – General Model – Inductive Learning – Learning Decision

Tree – Reinforcement Learning – Knowledge in Learning – Communicative Agents – Types of Communicative Agents – Future of AI.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

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

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.

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 (Common to M.Tech (CSE, CSE-BDA))	L	T	P	C
		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.

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.

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

OBJECTIVES:

- To study about classical software engineering life cycle model.
- To discuss the implications of various aspects of software engineering
- To investigate principles of object-oriented software engineering, from analysis through testing.
- To learn techniques at each stage of development, including use cases, UML.

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

- describe the basic concepts of software development life cycle.
- explore the different UML diagrams and tools for the same.
- identify the different design and testing techniques.
- build successful teams for projects.

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

OBJECTIVES:

- to introduce advanced operating system concepts with emphasis on foundations & design principles.
- Different components of operating system are covered.

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

- express coherently in a single page the role of operating system.
- evaluate the algorithms used in operating systems.
- analyze the structure of operating systems and evaluate the relationship between the application programs that work on them.
- review the state of art in operating systems design and come up with atleast one new innovation at any of the layers.

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.

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:

- This course provides a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications by introducing and researching state-of-the-art Cloud Computing fundamental issues, technologies, applications and implementations.
- To expose the students to frontier areas of Cloud Computing and information systems and provide sufficient foundations to enable further study and research.

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

- identify constraints, tradeoffs and techniques in setting up and using Cloud Computing through its enabling technologies.
- gain competence in evaluating the performance and identifying bottlenecks when mapping applications to the cloud.
- provide the appropriate cloud computing solutions and recommendations according to the applications used.

SSB7181 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.

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

- understand 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.

GROUP II - BIG DATA STREAM

CSBY94	**SOCIAL MEDIA MINING (Common to M.Tech (CPA, CSE-BDA))**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To understand the fundamentals of Social media and related concepts.
- To study the procedures for community classification.
- To experiment with social media data extraction and analysis.

MODULE I FUNDAMENTALS OF SOCIAL MEDIA 8

Key concepts of social media mining - Good data versus bad data - Understanding sentiments- Scherer's typology of emotions - Sentiment polarity - data and classification - Supervised social media mining - lexicon-based sentiment - Supervised social media mining - Naive Bayes classifiers - Unsupervised social media mining - Item Response Theory for text scaling - Social Computing Tasks - Importance of Nodes - Strengths of Ties - Influence Modeling.

MODULE II SOCIAL MEDIA DATA 7

The nature of social media data - Traditional versus nontraditional social data - Measurement and inferential challenges - Opinion mining made difficult - Sentiment and its measurement - Big Data - Human Sensor and Honest Signals - Quantitative approaches - Challenges.

MODULE III COMMUNITIES AND SOCIAL MEDIA 8

Types of Communities - Node-Centric Community Detection - Group-Centric Community Detection - Network-Centric Community Detection - Hierarchy-Centric Community Detection.

MODULE IV PATTERNS AND CLASSIFICATION IN SOCIAL MEDIA 7

Pattern Evolution - A Naïve Approach to Studying Community Evolution - Community Evolution in Smoothly Evolving Networks - Segment-based Clustering with Evolving Networks - Classification with Network Data - Collective Classification - Community-based Learning.

MODULE V R FUNDAMENTALS 8

Introduction to R - Assignment and arithmetic basics - Functions - Arguments - Vectors, sequences, and combining vectors - Creating data frames and importing files - Visualization in R - Style and workflow.

MODULE VI CASE STUDY: MINING TWITTER DATA 7

Twitter API - Search and Extraction of Tweets, Retweets - Graph Visualization of Tweets , Retweets - Tag Clouds - Harvesting Friends and Followers - Analysis of Relationships, Cliques - Geodata.

Total Hours: 45

REFERENCES:

1. Richard Heimann, Nathan Danneman, "Social Media Mining with R", Packt Publishing, March 2014.
2. Lei Tang, Huan Liu "Community Detection and Mining in Social Media", Morgan and Claypool Publishers,1st Edition, 2010.
3. Matthew A. Russell, "21 Recipes for Mining Twitter", O'Reilly Media, January 2011.
4. Yangchang Zhao, "R and Data Mining, Examples and Case Studies", Academic Press; 1st Edition , 2012.

OUTCOMES:

Students who complete this course will be able to

- predict the significance of social media and its impact in the real time scenarios.
- analyze the social media networks by applying various methods of analysis, tools and techniques.
- apply the social media mining concepts to real world situations and derive useful knowledge.

CSB6271	KNOWLEDGE DISCOVERY TECHNOLOGIES (Common to M.Tech (CPA, CSE-BDA))	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce Knowledge Discovery techniques/methods and their application.
- To help the students to extract useful knowledge from large volumes of data by prediction and clustering methods.
- To understand the sequence in which the data mining projects should be performed.

MODULE I INTRODUCTION **7**

Data Mining-Knowldege Discovery Process–Data Understanding –Data – Concepts of Learning-Classification-Summary –Knowledge representation—Cate-set and interval-Fuzzy sets.

MODULE II DATA PREPROCESSING **7**

Subverting Knowledge discovery-Effects of technology properties-Sense making and situational awareness.

MODULE III RISK PREDICTION AND ANAMOLY DETECTION **7**

Goals-Problems-Human variability-Computational difficulty- Rarity- Justifiable preemption-Hindsight Bias-Outline of prediction-attributes - Missing values - Reason – Errors - Ranking-Technologies.

MODULE IV SIMILARITY CLUSTERING **8**

Goals-Clustering technology- Distance based-density based- Distribution based-Decomposition based-Hierarchical-biclustering-clusters and prediction-Symbiotic clustering E-Health perspectives-Ehealth records-EHealth-EPublic health Information system.

MODULE V RELATIONSHIP DISCOVERY **8**

Goals-Outline of Textual analysis-Technologies-Discovery - Public textual data.

MODULE VI KNOWLEDGE IN PRIVATE COMMUNICATION **8**

Concealment Opportunities –Technologies-Tactics and Process-Discovery of mental and Emotional state-Sentiment Analysis

Total Hours : 45

REFERENCES:

1. David Skillicorn, “Knowledge Discovery for Counterterrorism and Law Enforcement”, 1st Edition, Chapman & Hall/CRC Data Mining and Knowledge Discovery Series, 2008.

2. Krzysztof J. Cios, Witold Pedrycz, Roman W. Swiniarski, Lukasz Andrzej Kurgan, “Data Mining: A Knowledge Discovery Approach”,1st Edition, Springer Science & Business Media LLC, 2007.

OUTCOMES:

Students who complete this course will be able to

- preprocess the data and apply appropriate algorithms.
- integrate knowledge discovery tools.
- map data mining techniques with the applications that handle uncertainty, prediction, etc.

CSB6272	WEB ANALYTICS	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES

- To provide overview and establish the need for web analytics.
- To understand and apply metrics to analyze the web data.
- To provide exposure to usage of web analytic tools.

MODULE I INTRODUCTION TO WEB ANALYTICS 7

A Brief history of Web Analytics –Web Analytics Terminology – Traditional Web Analytics – Web Analytics 2.0 – Capturing Data- Tools Selection – Quality Aspects –Implementing Best Practices.

MODULE II WEB DATA COLLECTION 9

Web Traffic Data – Web Transactional Data – Web Server Data – Page Weights – Usability Studies – User Submitted Information – Integrating Form based data – Web Data Sources – Server Log Files – Page Tags – Clickstream Data –Outcomes Data – Research Data –Competitive Data.

MODULE III WEB ANALYTICS STRATEGY 7

Component of Web Analytics Strategy – Customer Centric Focus – Business Problem Solving Focus – Reporting vs Analysis – IT and Business Strength – Clickstream vs Web 2.0 – Vendor Specific Options and Issues.

MODULE IV METRICS AND KPIs 7

Measuring Reach – Measuring Acquisition – Measuring Conversion – Measuring Retention – Focus on 'Critical Few'- Key Performance Indicators – Case Studies.

MODULE V DATA ANALYSIS 7

Customer centricity – Lab Usability Studies – Usability Alternatives – Surveys – Heuristic Evaluations - Web enabled user research options – Competitive Intelligence Analysis

MODULE VI WEB ANALYTICS TOOLS 8

Content organization tool – Process measurement tools- Visitor Segmentation

Tools- Campaign Analysis – Commerce Measurement Tools -Google Analytics – Piwik Web Analytics – Yahoo Web Analytics – Emerging Analytics: Social, Video, Mobile.

Total Hours : 45

REFERENCES:

1. Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity”, 1st Edition, Sybex, 2009.
2. Brian Clifton, “Advanced Web Metrics with Google Analytics”, 3rd Edition, Sybex , 2012.
3. Eric Peterson, “Web Analytics Demystified:A Marketer's Guide to Understanding How Your Web Site Affects Your Business” ,1st Edition, Celilo Group Media, 2004.
4. Avinash Kaushik, “Web Analytics: An Hour a Day”, 6th Edition, Sybex, PAP/ CDR Edition, 2007.
5. Justin Cutroni, “Google Analytics”, 2nd Edition, O'Reilly Media, 2010.

OUTCOMES:

Students who complete this course will be able to

- explore web data and apply the learning to improve the quality of web sites.
- use various tools and study real-time websites for enhancing business performance.

CSBY83	CLUSTER ANALYSIS	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To establish the difference between classification and clustering.
- To provide insights into the theoretical foundations behind varied methods of clustering and association analysis.
- To expose to the feature extraction techniques involved in clustering.
- To introduced optimization clustering algorithms
- To discuss applications of clustering in different fields.

MODULE I CLASSIFICATION AND CLUSTERING 9

Reasons for classification - Defining a cluster -Examples of use of clusters: Market research - Astronomy - Psychiatry - Weather classification - Archaeology - Bioinformatics and genetics.

MODULE II FEATURE EXTRACTION 6

Feature Extraction - Distance Measure - Euclidean distance - Mahalonobis distance - Manhattan distance.

MODULE III CLASSIFICATION 7

Classification: Classification – Decision Tree Induction – Bayesian Classification – Prediction –Back Propagation.

MODULE IV OPTIMIZATION CLUSTERING TECHNIQUES 8

Clustering criteria derived from the dissimilarity matrix - Clustering criteria derived from continuous data - Optimization algorithms - Choosing the number of clusters - Applications of optimization methods.

MODULE V CLUSTER ANALYSIS 9

Cluster analysis: Types of data – Clustering Methods – K-Means clustering-K-Medoid clustering-Hierarchical clustering-agglomerative clustering- Partitioning methods – Model based clustering methods – Outlier analysis.

MODULE VI APPLICATIONS **6**

Cluster analysis applications in image processing-Data mining and warehousing-Neural networks-Genetic algorithms.

Total Hours: 45

REFERENCES:

1. Sugato Basu, Ian Davidson, Kiri L.wagsstaff, “Constrained Clustering: Advances in Algorithms, Theory, and Applications”, 1st Edition, Chapman and Hall/CRC press, 2008.
2. Paulraj Ponnaiah,” Data Warehousing Fundamentals”, 1st Edition, Wiley Publishers, 2004.
3. Brian S. Everitt, Sabine Landau, Morven Leese, and Daniel Stah, “Cluster Analysis”, 5th Edition ,Wiley, 2011.
4. Mark Nixon, Alberto S Aguado, “Feature Extraction & Image Processing”,2nd Edition, Academic Press, 2008.

OUTCOMES:

Students who complete this course will be able to:

- discriminate between clustering and classification problems.
- apply data reduction and data preprocessing techniques for clustering.
- appraise feature extraction methods and identify the suitable method for a given problem.
- compare and contrast between pattern recognition techniques.
- recognize the need for optimization algorithms.

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CSBY84 CLASSIFICATION METHODS AND EVALUATION **L T P C**
(Common to M.Tech (CPA, CSE-BDA)) **3 0 0 3**

OBJECTIVES:

- To learn the basics of pattern recognition techniques.
- To understand the various classification techniques.
- To apply the classification algorithms and design applications.

MODULE I PATTERN RECOGNITION SYSTEMS **7**

Machine Perception - Pattern Recognition Systems - The Design Cycle - Learning and Adaptation.

MODULE II BAYESIAN DECISION THEORY **8**

Introduction - Bayesian Decision Theory Continuous Features - Minimum Error Rate Classification - Classifiers, Discriminant Functions and Decision Surfaces - The Normal Density - Discriminant Functions for Normal Density - Error Probabilities and Integrals - Error Bounds for Normal Densities - Bayes Decision Theory Discrete Features - Missing and Noisy Features - Bayesian Belief Networks - Compound Bayesian Decision Theory and Contexts.

MODULE III MAXIMUM-LIKELIHOOD, BAYESIAN PARAMETER ESTIMATION **7**

Introduction - Maximum-Likelihood Estimation - Bayesian Estimation - Gaussian Case - General Theory - Problems of Dimensionality - Component Analysis and Discriminants - Expectation - Maximization - Hidden Markov Models.

MODULE IV NONPARAMETRIC TECHNIQUES **7**

Introduction - Density Estimation - Parzen Windows - Nearest Neighbour Estimation - The Nearest Neighbour Rule - Metrics - Nearest-Neighbour Classification - Fuzzy Classification - Reduced Coulomb Energy Networks - Approximations by Series Expansions.

MODULE V LINEAR DISCRIMINANT FUNCTIONS **8**

Introduction - Linear Discriminant Functions and Decision Surfaces - Generalized Linear Discriminant Functions - The Two-Category Linearly Separable Case - Minimizing the Perceptron Criterion Function - Relaxation

Procedures – Non-separable Behavior - Minimum Squared-Error Procedures - The Ho-Kashyap Procedures – Multi-category Generalizations.

MODULE VI MULTILAYER NEURAL NETWORKS 8

Introduction - Feed Forward Operation and Classification - Back Propagation Algorithm - Error Surfaces - Back Propagation as Feature Mapping -Back Propagation, Bayes Theory, Probability - Practical Techniques for Improving Back Propagation.

Total Hours: 45

REFERENCES:

1. Richard O. Duda, Peter E. Hart, “Pattern Classification”, 2nd Edition, John Wiley, 2000.
2. Geoff Dougherty, “Pattern Recognition and Classification: An Introduction”, 1st Edition, Springer, 2012.

OUTCOMES:

Students who complete this course will be able to

- identify the pattern that is suitable for any particular field.
- recognize the best possible classification techniques based on requirements.
- apply the concepts to the real problems.

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MAB6195	MULTIPLE LINEAR REGRESSION (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 0 3

OBJECTIVES:

- To study about regression model and the evaluation and analysis using a modern approach.
- To provide a concise overview of regression tools.
- To understand the tools and explore a set of data using the tools.

MODULE I REGRESSION ANALYSIS 8

Regression Analysis - Preliminaries-Naïve Non Parametric Regression – Local Averaging-Univariate Displays-Plotting Bivariate data -Transforming Data.

MODULE II LINEAR MODELS AND LEAST SQUARES 8

Linear Least Square Regression – Simple Regression – Multiple Regression – Statistical Inference for Regression –Dummy Variable Regression – Linear Models in Matrix Form – Least Square Fit- Properties of the Least Square Estimator-Statistical Inference of Linear Models. Analysis of Variance.

MODULE III MULTIPLE LINEAR REGRESSION MODEL 7

Multiple linear regression model- Hypothesis tests in multiple linear regression-Confidence intervals in multiple linear regression-Prediction of new observations-Model Adequacy Checking -Aspects of multiple regression modeling.

MODULE IV MLR MODEL APPLIED TO VARIANCE PROBLEMS 8

One way classification-Regression treatment using the original model-Regression treatment of the one way classification-Independent normal equations-The two way classification with equal number of observations in the cells-Regression treatment of two way classification.

MODULE V REGRESSION DIAGNOSTICS 7

Simple Approaches to Diagnosing Problems in Data - Residual Analysis: Detecting Outliers and Violations of Model Assumptions- Strategies of Analysis-Collinearity- Scaling Problems- Diagnostics Example- Polynomial regression-Polynomial Models- Least-squares Procedure for Fitting a Parabola- ANOVA Table for Second-order.

MODULE VI POLYNOMIAL REGRESSION **7**

Polynomial Regression- Inferences Associated with Second-order Polynomial Regression-Example Requiring a Second-order Model- Fitting and Testing Higher-order Model- Lack-of-fit Tests-Orthogonal Polynomials- Strategies for Choosing a Polynomial Model-Problems.

Total Hours: 45

REFERENCES:

1. John Fox, “Applied Regression Analysis and Generalised Linear Models”, 2nd Edition, Pearson Education, 2011.
2. Douglas C. Montgomery; George C. Runger, “Applied Statistics and Probability for Engineers”, 5th Edition, John Wiley & Sons, 2010.
3. Kleinbaum, Kupper, Nizam, and Muller “Applied Regression Analysis and Other Multivariable Methods”, 4th Edition, Brooks/Cole, Cengage Learning, 2008.

OUTCOMES:

Students who complete this course will be able to

- use multiple regression techniques to build empirical models in engineering and scientific data.
- understand how the method of least squares extends to fitting multiple regression models.
- describe the statistical properties in regression analysis, interterpret regression relations in terms of conditional distributions.

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CSYB85	NATURAL LANGUAGE PROCESSING (Common to M.Tech (CPA, CSE-BDA))	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a general introduction including the use of state automata for language processing.
- To provide the fundamentals of syntax including a basic parse.
- To explain advanced feature like feature structures and realistic parsing methodologies.
- To explain basic concepts of remotes processing.
- To give details about a typical natural language processing applications.

MODULE I INTRODUCTION **7**

Introduction: Knowledge in speech and language processing - Ambiguity - Models and Algorithms - Language, Thought and Understanding- Regular Expressions and automata: Regular expressions - Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology - Finite-State Morphological parsing - Combining FST lexicon and rules - Lexicon-Free FSTs: The porter stammer - Human morphological processing.

MODULE II SYNTAX **8**

Word classes and part-of-speech tagging: English word classes - Tagsets for English - Part-of-speech tagging - Rule-based part-of-speech tagging - Stochastic part-of-speech tagging - Transformation-based tagging - Other issues - Context-Free Grammars for English: Constituency - Context-Free rules and trees - Sentence-level constructions - The noun phrase - Coordination - Agreement - The verb phase and sub categorization - Auxiliaries - Spoken language syntax - Grammars equivalence and normal form - Finite-State and Context-Free grammars - Grammars and human processing. Parsing with Context-Free Grammars: Parsing as search - A Basic Top-Down parser - Problems with the basic Top-Down parser - The early algorithm - Finite-State parsing methods.

MODULE III ADVANCED FEATURES AND SYNTAX **8**

Features and Unification: Feature structures - Unification of feature structures - Features structures in the grammar - Implementing unification - Parsing with

unification constraints - Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar - Problems with PCFGs - Probabilistic lexicalized CFGs - Dependency Grammars - Human parsing.

MODULE IV SEMANTIC 8

Representing Meaning: Computational desiderata for representations - Meaning structure of language - First order predicate calculus - Some linguistically relevant concepts - Related representational approaches - Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis - Attachments for a fragment of English - Integrating semantic analysis into the early parser - Idioms and compositionality - Robust semantic analysis. Lexical semantics: relational among lexemes and their senses - WordNet: A database of lexical relations - The Internal structure of words - Creativity and the lexicon.

MODULE V APPLICATIONS 7

Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation - Robust word sense disambiguation - Information retrieval - Other information retrieval tasks.

MODULE VI NATURAL LANGUAGE GENERATION 7

Introduction to language generation - Architecture for generation - Surface realization - Discourse planning - Other issues- Machine Translation: Language similarities and differences - The transfer metaphor - The interlingua idea: Using meaning - Direct translation - Using statistical techniques - Usability and system development.

Total Hours: 45

REFERENCES:

1. Daniel Jurafsky & James H.Martin, “Speech and Language Processing", 2nd Edition, Pearson Education, 2009.
2. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Education, 2008.
3. Manning, Christopher D and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, Cambridge, 1st Edition, MA: MIT Press, 1999.

OUTCOMES:

Students who complete this course will be able to

- describe approaches to syntax and semantics in NLP.
- examine different approaches for discourse, generate, dialogue and summarize in NLP.
- summarize and evaluate current methods for statistical approaches to machine translation.
- reproduce various machine learning techniques used in NLP.

CSBY86	MARKET ANALYTICS	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce the principles and strategic concepts of marketing analytics.
- To understand cost concepts (TOTAL HOURS, fixed, variable), profit margins, and lifetime value of the customer.
- To get an overview of the benefits and objectives of quantitative marketing.

MODULE I INTRODUCTION 7

Introduction to Marketing Analytics – Market Insight – Market sizing and trend analysis.

MODULE II MARKET SEGMENTATION 7

Market segmentation – Segment identification, analysis, and strategy, Competitive analysis- Competitor identification, analysis and strategy.

MODULE III BUSINESS STRATEGY AND OPERATIONS 7

Business Strategy - Analytics-based strategy selection - Business Operations - Forecasting, predictive analytics, and data mining.

MODULE IV PRODUCT, SERVICE AND PRICE ANAYTICS 8

Product and Service Analytics - Conjoint analysis and product/service metrics, Price Analytics - Pricing techniques and assessment.

MODULE V DISTRIBUTION AND PROMOTION ANALYTICS 8

Distribution Analytics - Analytics-based channel evaluation and selection -. Promotion Analytics - Promotion budget estimation and allocation.

MODULE VI SALES ANALYTICS AND ANALYTICS IN ACTION 8

Sales Analytics - Metrics for sales, profitability, and support-. Analytics in Action - Pivot tables and data-driven presentations.

Total Hours : 45

REFERENCES:

1. Stephan Sorger, “Marketing Analytics: Strategic Models and Metrics”, 1st

Edition, vCreate Space Independent Publishing Platform, 31-Jan-2013.

2. Stephan Sorger, “Marketing Planning: Where Strategy Meets Action”, 1st Edition, Prentice Hall PTR, 03-Sep-2011.

3. Cesar A.Brea, “Pragmalytics : Practical approaches to the Marketing analytics in the Digital Age”,1st Edition, iUniverse, 2012.

OUTCOMES:

Students who complete this course will be able to

- interpret the benefits and objectives of marketing analytics.
- apply metrics -driven techniques to improve marketing decisions.
- implement best practices through case studies.
- design hands-on computer spreadsheet models and metrics.

CSYB87	TEXT ANALYTICS	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To interpret the basics of text analysis.
- To infer about text mining, text analytics and web analytics.
- To illustrate the domains that makes up text analytics and web analytics.

MODULE I HISTORY OF TEXT MINING 6

Roots of text mining - Information extraction and text mining - Development of enabling technology in text mining - Sentiment analysis and opinion mining.

MODULE II BASICS OF TEXT ANALYTICS 6

Definition - Business challenges addressed: information organization and access - Discovery of patterns – Discovery.

MODULE III SEVEN PRACTICE AREAS OF TEXT ANALYTICS 6

Seven practice areas of text analytics - Finding the appropriate solution to a problem - Overall relationship - Visualizing the domains of text analytics.

MODULE IV WEB ANALYTICS AND WEB MINING 9

Value of web analytics - Components of web mining - Concepts and terminology in web analytics - Web analytics and web mining - Optimal paths to successful web analytics evolution in a company.

MODULE V FUTURE OF TEXT AND WEB ANALYTICS 9

Text analytics and text mining - Future of web analytics - Future of text mining - Integration of web analytics with standard business intelligence tools - New areas that may use text analytics.

MODULE VI CASE STUDY - GOOGLE ANALYT 9

Key features and capabilities - Operation - Google analytics limits - Limitations of Google analytics - Google analytics and privacy.

Total Hours: 45

REFERENCES:

1. Gary Miner John Elder IV, Robert Nisbet, Dursun Delen, Thomas Hill, Andrew Fast, "Practical Text Mining and Statistical Analysis for Non-structured Text Data Applications",1st Edition, Academic Press, 2012.

2. Brian Clifton Sybex, "Advanced Web Metrics with Google Analytics", 3rd Edition, Pearson education, 2012.

OUTCOMES:

Students who complete this course will be able to

- relate text mining to analytics.
- explore the domains of text analytics according to user's view.
- depict the relationship of text analytics and web analytics.
- predict the future of text analytics.

CSBY88	PRECISION MARKETING	L	T	P	C
	(Common to M.Tech (CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To help break down the perspectives, capabilities and skills necessary to deliver more powerful marketing results.
- To provide resources to help the champions of change promote this approach in a way that gains the support of other senior decision-makers and decision-influencers.
- To provide vivid examples of how other leading companies, across industries, geographies and applications are employing insight-driven marketing to deepen customer relationships and achieve profitable growth.

MODULE I THE PRECISION MARKETING JOURNEY 8

Introduction: Why Relevance is Relevant -The 1-800-flowers journey- Precision Marketing in perspective-The Precision Marketing Framework-Best practices at Best Western-Take the Precision Marketing journey.

MODULE II DETERMINE OBJECTIVES AND GATHER DATA 7

Step one: Determine Your Objectives The Keys to effective objective

Step two: Gather Data-The role of data in Precision Marketing-Getting to your internal data-Other great sources of data-Touch Point activity-Best practices: reusing data, not re-asking for data-Collaborate to innovate-Relevance means for business.

MODULE III ANALYSE AND MODEL 7

Step three: Analyze and Model-The Segmentation Scale-Moving towards precision-The predictive Precision Marketer- Modeling for results.

MODULE IV STRATEGIZE 7

Step four: Strategize-Creating your customer strategy-The Communication Matrix-Strategy in action-Developing relevant content-Developing content by focus groups-Developing the right message-Measurable content-Strategies that succeed.

MODULE V DEPLOY AND MEASURE **8**

Step five: Deploy-The campaign deployment-Market test-7-Eleven answers the phone-Scaling for success.

Step six: Measure –Gearing up for growth-Metrics for B2B marketing.

MODULE VI CASE STUDY **8**

The Precision Marketer's Moment - Precision Marketers' careers - Case study-The future precision marketing-Career paths for Precision Marketers.

Total Hours : 45

REFERENCES:

1. Sandra Zoratti, Lee Gallagher, “Precision Marketing: Maximizing Revenue Through Relevance”, 1st Edition, Kogan Page Publishers, 2012.
2. Jeff Zabin and Gresh Brebach, “Precision Marketing: The New Rules for Attracting, Retaining, and Leveraging Profitable”, 1st Edition, John Wiley Publications, 2004.

OUTCOMES:

Students who complete this course will be able to

- recognize, identify and provide the concepts of precision marketing to set them apart and reach a whole new level of growth can be capitalized.
- describe the real-world account of becoming a social business through the use of data to drive customer engagement.
- achieve today's successful business and marketing strategies..

CSBY89	COMPLEX EVENT PROCESSING (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 0 3

OBJECTIVES:

- To elucidate the set of tools and techniques for analyzing and controlling the complex series of interrelated events that drive modern distributed information systems.
- To help IS and IT professionals understand about the system to solve problems.
- To introduce CEP and show how this innovative technology can be utilized to enhance the quality of large-scale, distributed enterprise systems.

MODULE I EVENT NETWORKS 6

Understanding event types - Explicit events - Raising events - Rule abstractions - Error handling - Event intermediaries - Complex event scenarios.

MODULE II COMPLEX EVENT PROCESSING 6

Event causality - Vertical causality - Event aggregation - Dynamics working towards CEP – Applications.

MODULE III EVENTS TIME AND CAUSALT 8

Time causality and aggregation - Cause time axiom - Genetic parameters in events - time stamps - causal vectors - causality and posets -Observation and uncertainty.

MODULE IV EVENT PATTERNS, RULES, AND CONSTRAINTS 7

Common Kinds of Pattern Searching - Event Patterns - A Strawman Pattern Language - Pattern Matching - Writing Patterns in STRAW-EPL - Event Pattern Rules - Constraints.

MODULE V COMPLEX EVENTS AND UNCERTAINTIES 9

Aggregation and Complex Events - Creating Complex Events - Event Abstraction Hierarchies - Viewing a Fabrication Line - Building Personalized Concept Abstraction Hierarchies - Viewing Network Activity - Viewing Stock-Trading Activity.

MODULE VI INFRASTRUCTURE FOR COMPLEX EVENT PROCESSING 9

Architecture of central complex event processing – Application to modern challenges like RFID, Sensor Networks – Features: Automatic and real time routing, caching, filtering, aggregation and processing.

Total Hours: 45

REFERENCES:

1. David Luckham, “The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems”, Addison Wesley, 2010.
2. Richard Seroter, Ewan Fairweather, Stephen W. Thomas, Mike Sexton and Rama, “Applied Architecture Patterns on the Microsoft Platform”, Ramani Packt Publishing, 2010.

OUTCOMES:

Students who complete this course will be able to

- analyze the challenges faced by today's information systems.
- evaluate CEP's role within a complex and evolving contemporary context.
- effectively utilize events for enhanced operation, performance identify and security.

CSBY90	RISK ANALYSIS AND MANAGEMENT (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 0 3

OBJECTIVES:

- To understand project risk management system through which project risk can be identified, evaluated, and managed.
- To demonstrate tools and techniques used to identify and assess project risk.
- To study how to effectively process sensor data for location and context.

MODULE I INTRODUCTION TO RISK ANALYSIS 8

Introduction - Risk analysis –Variability and uncertainty of risk analysis-Risk analysis modeling-Probabilistic risk analysis for complex engineering system-Ecological risk analysis-Economics of risk Privacy.

MODULE II APPLICATION OF RISK ANALYSIS 8

Role of risk assessment in human health – Role of risk analysis in pollution prevention-Integrated risk analysis and global climate change-Computer software programs-databases –www- Other online systems- Use of internet.

MODULE III RISK PERCEPTION AND COMMUNICATION 8

Risk perception and trust- Insurability of risk – Setting environmental priorities based on risk—Comparative risk analysis – Law and risk assessment –Science and toxic risk assessment.

MODULE IV RISK MANAGEMENT 7

Risk management process-Identify-assess-plan responses-Manage process –PRAM Process – Three cycles of strategic level risk management.

MODULE V RISK ORGANISATION & CONTROL 7

Organizational structure- Responsibilities – Functional roles – Risk response actions - Control risk documentation – Risk reporting – Risk governance – Risk reviews –Behavioral influences.

MODULE VI TOOLS AND TECHNIQUES 7

Selecting tools and techniques– Risk identification techniques –SWOT analysis

– Stakeholder analysis-Nominal group techniques –Delphi technique-technology readiness levels –Qualitative risk assessment techniques.

Total Hours: 45

REFERENCES:

1. Vlasta Molak, “Fundamentals of Risk Analysis and Risk Management”, 2nd Edition, CRC Press, Lewish Publishers, 2000.

2. John Bartlet, “Project Risk Analysis and Management Guide”, 2nd Edition, ARM Publishing Ltd, 2004.

OUTCOMES:

Students who complete this course will be able to

- identify, formulate, and solve engineering problems in risk management.
- apply knowledge of mathematics, science, and engineering to the assessment of risk.
- implement tools and techniques to evaluate risk in projects.

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CSBY91	INTELLIGENT INFORMATION RETRIEVAL (Common to M.Tech (CPA, CSE-BDA))	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To express the role of logic in knowledge Engineering.
- To describe the role of ontology as a representational and reasoning mechanism in information retrieval.
- To show how effective information search and retrieval is interrelated with the organization and description information to be retrieved.
- To discuss the classification and clustering algorithms.

MODULE I KNOWLEDGE REPRESENTATION 6

Knowledge representation - Basics of Propositional logic - Predicate logic-Reasoning using

First Order Logic- Unification - Forward chaining - Backward chaining - Resolution.

MODULE II ONTOLOGY DEVELOPMENT 7

Description logic-taxonomies-Topic maps-Ontology-Definition-expressing ontology logically-ontology representations-XML-RDF-RDFS-OWL-OIL-Ontology development for specific domain-ontology engineering.

MODULE III INFORMATION RETRIEVAL 7

Parallel and distributed IR- Multimedia IR- Data modeling- Query languages - Web Searching

Basics -Characterizing the Web-Search Engines-Web crawling and indexes-Link analysis.

MODULE IV INFORMATION RETRIEVAL MODELING 9

Information retrieval – Taxonomy - formal characterization - Classic information retrieval -Set theoretic model - Algebraic model - Probabilistic model - Structured text retrieval models - Models for browsing - Retrieval performance evaluation - Keyword based querying - Pattern matching – structural queries – Query operations.

MODULE V CLASSIFICATION **8**

Language models for information retrieval – text classification, Naive bayes – Vector space classification.

MODULE VI CLUSTERING **8**

Support vector machines and machine learning on documents-Flat clustering-Hierarchical clustering-Case study on cluster analysis.

Total Hours: 45

REFERENCES:

1. Stuart Russell-Peter Norvig, “Artificial Intelligence – A modern Approach”, 3rd Edition, Pearson Education, 2009.
2. Michael C.Daconta, Leo J. Obart and Kevin J Smith, “Semantic Web – A guide to the future of XML, Web Services and Knowledge Management”, Wiley Publishers, 2003.
3. Elain Rich, Kevin Knight, B. Nair, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2008.
4. Christopher D. Manning,Prabhakar Raghavan and Hinrich Schutze, “Introduction to Information Retrieval”, 1st Edition, Cambridge University press, 2008.

OUTCOMES:

Students who complete this course will be able to

- apply knowledge in logical form and construct ontology for different domains.
- recognize how the web search works and summarize the models for information retrieval.
- analyze the role of classification and clustering algorithms.

CSBY92	SOCIAL NETWORK ANALYSIS AND MINING (Common to M.Tech (CPA, CSE-BDA))	L 3	T 0	P 0	C 3

OBJECTIVES:

- To give an overview of social networks and its importance.
- To understand the social network concepts and various methods of analysis.
- To expose and train on various tools and techniques for analyzing and visualizing social media networks.

MODULE I INTRODUCTION TO SOCIAL NETWORKS and SNA 7

Connected World – Networks: Actors, Relations and Attributes - Networks as Information Maps - Networks as Conduits – Leaders and Followers – Psychological foundations of social networks – Basic building Blocks - Brief history of Social Network Analysis.

MODULE II NETWORK CONCEPTS 8

Individual Members of the Network – Sociological Questions about Relationships – Whole Social Networks- Distributions – Multiplexity – Roles and Positions – Network Segmentation – Graph Theory – Notations for Social Network Data.

MODULE III SOCIAL NETWORK ANALYSIS FUNDAMENTALS 8

Points, Lines and Density – Centrality and Centralization – Components, Cores and Cliques – Positions, Roles and Clusters – Dimensions and Displays.

MODULE IV METHODS OF SOCIAL NETWORK ANALYSIS 8

Graphs – Matrices – Relationship Measures – Centrality and Prestiges – Cliques – Structural Equivalence – Visual Displays – Bookmodels – Network Position Measures – Logit Models – Affiliation networks – Lattices.

MODULE V LEVELS OF ANALYSIS 7

Actor Level in Complete Networks – Actor Level in Ego Networks – Dyad Level – Triad Level – Subgroups Level – Network Levels – Positions and Roles Analysis.

MODULE VI TOOLS AND TECHNOLOGIES 7

Twitter Analytics – Facebook Analytics – Google+ Analytics – Google+ Ripples

– R for Social Network Analysis – Pajek – Network Visualization Tools - Analyzing Social Media Networks with NodeXL.

Total Hours : 45

REFERENCES:

1. Charles Kadushin, “Understanding Social Networks: Theories, Concepts, and Findings”, Oxford University Press, USA, 2011.
2. David Knoke, Song Yang, “Social Network Analysis”, 2nd Edition, SAGE Publications, 2007.
3. Christina Prell , “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.

OUTCOMES:

Students who complete this course will be able to

- describe the importance of social networks.
- summarize the theories and concepts of social networks.
- analyze the social networks by applying various methods of analysis, tools and techniques.

CSBY93	DATA VISUALIZATION (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 0 3

OBJECTIVES:

- To introduce the domain of data visualization.
- To expose the various techniques in data visualization.
- To showcase the applications of data visualization.

MODULE I DATA VISUALIZATION AND DATA MINING 6

Definition - Data preparation- Stages in data mining - visualization, clustering, predictive analysis relationship - Visualization design principles - Graphics design - Anatomy of a graph.

MODULE II DATA VISUALIZATION TECHNIQUES 9

Univariate data visualization: Bar chart, histograms, frequency polygram, box plots, dot plots - Bivariate data visualization - Multivariate data visualization: Histogram matrix, scatterplot matrix, multiple box plot and trellis plot - Visualizing groups - Dynamic techniques.

MODULE III CLUSTERING 9

Distance measures - Agglomerative hierarchical clustering - Partition based clustering - Fuzzy clustering.

MODULE IV PREDICTIVE MODELING 9

Predictive modeling - Testing modeling accuracy - Models predictive accuracy: Scatter plots - ROC charts - Lift charts.

MODULE V VISUALIZATION TOOLS 6

Decision trees - Linear regression - Logistical regression - Association rules - Clustering – SOM.

MODULE VI CASE STUDIES 6

Industry specific data mining - Data analysis case study - Credit scoring case study - Data mining non tabular data.

Total Hours: 45

REFERENCES:

1. Glenn J Myatt, Wayne P. Johnson, “Making sense of Data - A practical guide to data visualization, advanced mining methods and applications”, 1st Edition, Wiley, 2009.

2. Tom Soukup and Ian Davidson, “Visual Data Mining: Techniques and Tools for Data Visualization and Mining”, 1st Edition, John Wiley & Sons, 2002.

OUTCOMES:

Students who complete this course will be able to

- compare data mining and visualization.
- explain the different visualization models.
- classify the basic visualization and clustering techniques.
- apply these techniques to mine real-life situations.

CSBY79	OPTIMIZATION TECHNIQUES (Common to M.Tech (CPA, CSE-BDA))	L T P C 3 0 0 3

OBJECTIVES:

- To introduce methods of optimization to engineering students.
- To know numerous application in civil, environmental, electrical (control) engineering, and industrial engineering.
- To maintain a balance between theory, numerical computation, problem setup for solution by optimization software, and applications to engineering systems.

MODULE I INTRODUCTION, CLASSICAL OPTIMIZATION TECHNIQUES 8

Statement of an Optimization problem – Design vector – Design constraints – Objective function – Classification of Optimization problems - Single variable Optimization – Multi variable Optimization without constraints – Necessary and sufficient conditions for minimum/maximum – Multivariable Optimization with equality constraints- Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

MODULE II LINEAR PROGRAMMING 8

Standard form of a linear programming problem – Geometry of linear programming problems – Definitions and theorems – Solution of a system of linear simultaneous equations – Pivotal reduction of a general system of equations – Motivation to the simplex method – Simplex algorithm.

MODULE III NON-LINEAR PROGRAMMING 8

Unconstrianed Non-Linear Programming :- 1-dimensional minimization methods- Classification, Fibonacci method and Quadratic interpolation method -Constrianed Non-Linear Programming : Characteristics of a constrained problem – Classification - Basic approach of Penalty Function method- Basic approaches of Interior and Exterior penalty function methods- Introduction to convex Programming Problem.

MODULE IV TRANSPORTATION PROBLEM 7

Finding initial basic feasible solution by north – West corner rule, least cost method and Vogel's approximation method – Testing for optimality of balanced transportation problems.

MODULE V UNCONSTRAINED OPTIMIZATION TECHNIQUES 7

Analytical method -Newton's method- Golden-section search method - Univariate method - Powell's method - Steepest descent method.

MODULE VI DYNAMIC PROGRAMMING 7

Dynamic programming multistage decision processes – Types – Concept of sub optimization and the principle of optimality – Computational procedure in dynamic programming – Examples illustrating the calculus method of solution - Examples illustrating the tabular method of solution.

Total Hours: 45

REFERENCES:

1. S.Rao, "Engineering optimization: Theory and practice", 4th Edition, New Age International, 2009.
2. H.S. Kasene & K.D. Kumar, "Introductory Operations Research",3rd Edition, Springer India Pvt .LTd., 2002.
3. H.A. Taha, "Operations Research: An Introduction", 6th Edition, PHI Pvt. Ltd, 2004.

OUTCOMES:

Students who complete this course will be able to

- implement the fundamental optimization methods of operations research and operations research models in practical situations.
- determine appropriate models to use in practical situations.

CSBY78	MACHINE LEARNING TECHNIQUES (Common to M.Tech (CPA, CSE-BDA)	L T P C 3 0 0 3

OBJECTIVES:

- To expose to basic terms and terminologies of Machine Learning.
- To study the various algorithms related to supervised and unsupervised learning.
- To understand the different types of Machine Learning models and how to use them.

MODULE I INTRODUCTION TO MACHINE LEARNING 7

Machine Learning Fundamentals – Key Terminology – Types of Learning – Parametric Models – Non-Parametric Models – Dimensionality – Model Selection – Probability Basics.

MODULE II SUPERVISED LEARNING 9

Classification – K-nearest neighbors classification – Decision Trees – Naïve Bayesian Classification - Regression - Linear Regression – Logistic Regression – Tree Based Regression – Supervised Linear Dimension Reduction – Support Vector Machines.

MODULE III UNSUPERVISED LEARNING AND OTHER APPROACHES 9

Clustering – Types of Clustering – Apriori Algorithm - Unsupervised Linear Dimension Reduction – Principle Component Analysis – Independent Component Analysis – Singular Value Decomposition – Semi Supervised Learning – Anomaly Detection.

MODULE IV MACHINE LEARNING MODELS 8

Linear Models - Bayesian Models – Gaussian Models – Mixture Models - Latent Linear Models – Latent Ability Models – Discrete State Markov Models – Continuous State Markov Models – Hidden Markov Models.

MODULE V ADVANCED MACHINE LEARNING CONCEPTS 6

Multilayer Perceptrons – Kernel Machines – Combining Multiple Learners – Reinforcement Learning – Design of Machine Learning Experiments – Analysis of Machine Learning Experiments.

MODULE VI TECHNOLOGIES AND TOOLS **6**

Weka Basics – Machine Learning using Weka - Python for Machine Learning – Introduction to R Machine Learning using R– Big Data and Map Redue – Introduction to Apache Mahout.

Total Hours: 45

REFERENCES:

1. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, 1st Edition, Chapman and Hall/CRC, 2009.
2. Ian H. Witten, Eibe Frank, Mark A. Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, 3rd Edition, Morgan Kaufmann, 2011.
3. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, 1st Edition, Springer, 2007.
4. Drew Conway, John Myles White, “Machine Learning for Hackers”,1st Edition, O'Reilly Media, 2012.

OUTCOMES:

Students who complete this course will be able to

- describe the concepts and models of machine learning.
- design and implement algorithms for supervised and unsupervised learning.
- apply various tools and techniques for machine learning applications.