CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

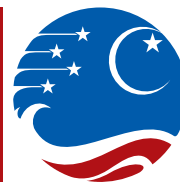## M. Tech.

COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN BIG DATA ANALYTICS

B.S.ABDUR RAHMAN
U N I V E R S I T Y

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)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

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JULY 2016

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UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science and 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

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership skills in students through various co-curricular and extra – curricular activities
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES:

- To impart knowledge and skills required for big data analysis required for computer professionals.
- To train on tools and techniques needed for big data analytics.
- To impart required analytical skills and application of tools in the domain of big data analytics.
- To undertake fundamental and applied research in the domain of big data analytics with social relevance.

PROGRAMME OUTCOMES:

On completion of the programme the graduates will

- Be able to apply the tools and techniques for analyzing real life situations encountered in big data.
- Have the capability to design and develop to model systems for handling Big data and apply appropriate statistical techniques.
- Be able to solve socially relevant problems through quality research in big data analytics.
- Be able to work as a team exhibiting effective managerial skills.

REGULATIONS – 2016
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 a 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, which is the apex body on all academic matters of this University

vi. **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S. Abdur Rahman University, who administers the academic matters.

vii. **"Dean (P.G. Studies)"** means Dean (P.G. Studies) of B.S. Abdur Rahman University who administers all P.G Programmes of the University in coordination with Dean (Academic Affairs)

viii. **"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S. Abdur Rahman University, who looks after the welfare and discipline of the students.

ix. **"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. /M.C.A. / M.Sc.	Full Time & Part Time – Day / Evening / Weekends

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. 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

In this mode of study, the students are required to attend classes for the courses in the time slots selected by them, during the daytime (or) evenings (or) weekends.

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   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. (Part Time)	9	18
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.C.A. (Part Time) – (Lateral Entry)	6	12
M.Sc. (Full Time)	4	8
M. Sc. (Part Time)	6	12

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

  i. Core courses
  ii. General Elective courses
  iii. Professional Elective courses
  iv. Project work / thesis / dissertation
  v. Laboratory Courses
  vi. Case studies
  vii. Seminars
  viii. Mini Project
  ix. 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. Mechanical / 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)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
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. (ECE / Electronics / E&I / I&C / EEE)
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)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
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 Science and Engineering with specialization in Big Data Analytics)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
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)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
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. – (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	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
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)	B.Sc.(Physics / Applied Science / Electronics / Electronics

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
			Science / Electronics & Instrumentation)
13	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry / Applied Science)
14	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Genetics	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Sc. Bioscience	B.Sc. in any branch of Life Sciences
		M. Tech. Biotechnology	B. Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

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

Programme	Minimum prescribed credits
M. Tech.	73
M.C.A.	120
M.Sc.	72

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 (or) 15 periods per semester
- 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
- One credit for 15 periods of lecture (can even be spread over a short span of time)

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	Full Time		Part Time	
	Non-project Semester	Project semester	Non-project Semester	Project semester
M. Tech.	9 to 28	12 to 28	6 to 12	12 to 28
M.C.A.	9 to 29	12 to 29	6 to 12	12 to 29
M.Sc.	9 to 25	12 to 20	6 to 12	12 to 20

3.9 The student may choose a course prescribed in the curriculum from any department depending on his / her convenient time slot. All attendance will be maintained course-wise only.

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

3.11 A student may be permitted by the Head of the Department to choose electives from other PG programmes either within the Department or from other Departments up to a maximum of nine credits during the period of his/her study, with the approval of the Head of the Departments offering such courses.

3.12 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.

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

3.14 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.

3.15 Project Work / Thesis / Dissertation

3.15.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a Faculty member in the concerned Department.

3.15.2 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.

3.15.3 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.

3.15.4 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.

3.15.5 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.

3.15.6 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.

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 for the courses within one week from the commencement of the semester

7.2   For the subsequent semesters registration for the courses will be done by the student one week before the last working day 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 Advisor for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Advisor.

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 Advisor. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

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

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

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

7.8 A student undergoing a full time PG Programme should have enrolled for all preceding semesters before registering for a particular semester

7.9 A student undergoing the P.G. programme in Part Time mode can choose not to register for any course in a particular semester with written approval from the head of the department. However the total duration for the completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1)

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 / Part time)	18
M.C.A. (Full time / Part time)	45
M.C.A. (Full time / Part time) – (Lateral Entry)	22
M.Sc.(Full time / Part time)	18

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.

11.0   ATTENDANCE

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

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

11.3   The students of Full Time mode of study, who have not attended a single hour in all courses in a semester and awarded 'I' grade are not permitted to

write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

12.0 SUMMER TERM COURSES

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

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

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

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

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

12.5 The summer term courses are not applicable for the students of Part Time mode.

13.0 ASSESSMENTS AND EXAMINATIONS

13.1 The following rule shall apply to all the PG programmes (M. Tech. / M.C.A. / M.Sc.)

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

13.2 There shall be one examination of three hours duration, at the end of the semester.

13.3 In one (or) two credit courses that are not spread over the entire semester, the evaluation will be conducted at the completion of the course itself. Anyhow approval for the same is to be obtained from the HoD and the Dean of Academic Affairs.

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

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

14.0 WEIGHTAGES

14.1 The following shall be the weightages for different courses:

i) Lecture based course

Two continuous assessments	50%
Semester-end examination	50%

ii) Laboratory based courses

Laboratory work assessment	75%
Semester-end examination	25%

iii) Project work

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

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

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

15.0 SUBSTITUTE EXAMINATION

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

15.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the department within a week from the date of missed assessment. However

the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

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

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

- Flexible range grading system will be adopted
- **"W"** denotes withdrawal from the course.
- **"I"**   denotes inadequate attendance and hence prevention from semester-end examination
- **"U"** denotes unsuccessful performance in a course.
- **"AB"** denotes absent for the semester end examination

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

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

17.0 AWARD OF LETTER GRADE

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

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

18.0 DECLARATION OF RESULTS

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

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

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

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

19.0 COURSE REPETITION AND ARREARS EXAMINATION

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

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

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

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

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

20.0   GRADE SHEET

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

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

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

(iii)   the total credits earned in that semester.

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

20.2   The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GP_i)}{\sum_{i=1}^{n}(C_i)}$$

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 ith course

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

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

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

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

20.3.1   For students under full time mode of study

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

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

20.3.2 For students under part time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above	First Class
All others	Second Class

For the purpose of classification, the CGPA will be rounded to two decimal places.

21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

21.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:
   i) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,
   ii) no disciplinary action is pending against him/her.

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

22.0 POWER TO MODIFY

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

CURRICULUM & SYLLABI FOR
M. Tech. (Computer Science and Engineering with Specialization in Big Data Analytics)

CURRICULUM
FOUR SEMESTERS / FULL TIME)

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6181	Applied Algebra and Discrete Algorithms	3	1	0	4
2	CSC6101	Advanced Computer Architecture	3	1	0	4
3	CSC6102	Algorithm Design and Implementation	3	0	2	4
4	CSC6103	Computer Networks and Management	2	0	2	3
5	CSC6104	Distributed Operating System	3	0	0	3
6	CSC6105	Advanced Software Engineering	3	0	0	3
7	CSC6106	Case Study 1	0	0	2	1
						22
		SEMESTER II				
1	GEC6201	Research Methodology For Engineers	3	0	0	3
2	CSC6201	Machine Learning Techniques	2	0	2	3
4	CSC6261	Statistics for Business Analytics	3	1	0	4
5		Professional Electives #				9
6	CSC6262	Case Study 2 / Term paper	0	0	2	1
						20
		SEMESTER III				
1	CSC7162	Big Data Analytics	3	0	0	3
2		General Elective	3	0	0	3
3		Professional Electives ##				6
4	CSC7161	Project – Phase I	0	0	12	6
						12
		SEMESTER IV				
1	CSC7161	Project work - Phase II ###	0	0	36	18
					6+18=	**24**
		Total				**78**

\#   Student has to take a minimum of 9 credits from the list of Electives.

\##   Student has to take a minimum of 9 credits from the list of Electives.

PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
LIST OF ODD SEMESTER ELECTIVES							
1	CSCY102	Agent Based Intelligent Systems	1	0	2	2
2	CSCY125	Risk Analysis and Management	3	0	0	3
3	CSCY161	Social Media Mining	2	0	2	3
4	CSCY162	Web Analytics	2	0	2	3
5	CSCY163	Cluster Analysis	3	0	0	3
6	CSCY164	Market Analytics	3	0	0	3
7	CSCY165	Text Analytics	3	0	0	3
8	CSCY166	Gaming Analytics	3	0	0	3
9	MAC6195	Multiple Linear Regression	3	0	0	3
LIST OF EVEN SEMESTER ELECTIVES							
1	CSCY204	Advanced Databases	3	0	0	3
2	CSCY212	XML and Web Services	1	0	2	2
3	CSCY213	Multimedia Systems	1	0	2	2
4	CSCY261	Knowledge Discovery Technologies	3	0	0	3
5	CSCY262	Classification Methods and Evaluation	2	0	2	3
6	CSCY263	Precision Marketing	3	0	0	3
7	CSCY264	Complex Event Processes	3	0	0	3
8	CSCY265	Data Visualization	2	0	2	3
9	CSCY266	Pattern Recognition	3	0	0	3
LIST OF SINGLE CREDIT ELECTIVE COURSES							
11	CSCY071	Wireless Network Programming	0.5	0	1	1
12	CSCY072	Cloud Computing Programming	0.5	0	1	1
13	CSCY073	Big Data Programming	0.5	0	1	1
14	CSCY074	Visual Systems Programming	0.5	0	1	1
15	CSCY075	Open Source Tools	0.5	0	1	1

GENERAL ELECTIVES FOR M. TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	3	0	0	3
2	GECY102	Society, Technology & Sustainability	3	0	0	3
3	GECY103	Artificial Intelligence	3	0	0	3
4	GECY104	Green Computing	3	0	0	3
5	GECY105	Gaming Design	3	0	0	3
6	GECY106	Social Computing	3	0	0	3
7	GECY107	Soft Computing	3	0	0	3
8	GECY108	Embedded System Programming	3	0	0	3
9	GECY109	Principles of Sustainable Development	3	0	0	3
10	GECY110	Quantitative Techniques in Management	3	0	0	3
11	GECY111	Programming using MATLAB & SIMULINK	1	0	2	2
12	GECY112	JAVA Programming	1	0	2	2
13	GECY113	PYTHON Programming	1	0	2	2
14	GECY114	Intellectual Property Rights	1	0	0	1

SEMESTER I

MAC6181	APPLIED ALGEBRA AND DISCRETE ALGORITHMS	L	T	P	C
		3	1	0	4

OBJECTIVES :

The aim of the course is to

- Make the students familiarize on the concepts of mathematical induction and codes.
- Motivate the students to solve problems applying techniques of logic.
- To have a knowledge on the concepts of Formal languages and Automata theory.
- Familiarize students with basics of graph theory.
- Train the students in applying the basic concepts of Cryptography.

MODULE I   INTEGERS, COMPUTER ALGEBRA AND CODES   09+03

Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

MODULE II   LOGIC   09+03

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – solving word problems - predicate logic - universal and existential quantifiers - proof techniques – direct and indirect – proof by contradiction – applications.

MODULE III   MODELING, COMPUTATION AND LANGUAGES   09+03

Finite state machines - deterministic and non-deterministic finite state machines - classes of grammars - phrase structure grammar - context sensitive - context-free - regular grammars - formal languages - ambiguity - Turing machines.

MODULE IV   GRAPH THEORY   09+03

Multigraphs - applications of graph theory - classes of graphs - subgraphs and morphisms - Hamilton circuits – planar graphs – shortest paths and spanning.

MODULE V   CIPHERS   09+03

Cryptography - cryptanalysis - substitution and permutation ciphers – block cipher – the playfair cipher – unbreakable ciphers – applications.

L – 45; T – 15

TEXT BOOKS :

1. Hopcraft, J. E, R. Motwani and Ullman, J. D, 'Introduction to Automata theory, Languages and Computation', Narosa publishing House, 4th edition 2006.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2015.
3. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.

REFERENCES :

1. Juraj Hromkovic, Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication and Cryptography, Springer, 2003.
2. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers and Discrete Algorithms, Second Edition (Discrete Mathematics and Its Applications), CRC Press, Newyork, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, 3rd Edition, 1993.

OUTCOMES :

Students who complete this course will be able to

- authenticate the correctness of the given statement using mathematical induction.
- test and analyze the logic of a program.
- apply the concept of finite state machines and to generate languages.
- analyze the types of graphs solve problems using the concepts of graph theory.
- apply encryption and decryption techniques to send messages securely.

CSC6101   ADVANCED COMPUTER ARCHITECTURE   L   T   P   C
                                                      3   1   0   4

OBJECTIVES :

- To understand the functional requirements and their role in the system design
- 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 how the memory hierarchy and optimization contribute to the performance of the system
- To understand the approaches in designing a new system through Instruction level parallel processing and to improve the Performance overcoming the hazards-meeting the functionality.
- To understand the data level parallel processing and Vector Processing for performance

MODULE I   FUNDAMENTALS OF COMPUTER DESIGN   09+04

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

MODULE II   MEMORY HIERARCHY DESIGN   09+03

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

MODULE III   INSTRUCTION LEVEL PARALLELISM   09+03

Concepts of ILP - Pipelining and hazards –Compiler techniques for exposing ILP-Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: IP6 Micro architecture. Compiler techniques for exposing ILP - Static branch prediction - Static multiple issues: VLIW - Advanced compiler support –Hardware VS software speculation.– Case study: Intel core i7 and ARM Cortex-A8

MODULE IV   DATA-LEVEL PARALLELISM   09+02

Vector Architecture - SIMD Instruction Set Extensions for Multimedia - Graphic Processing Units- Detecting and Enhancing Loop Level Parallelism - Mobile verses Server GPUs - Case Studies

MODULE V   THREAD LEVEL PARALLELISM   09+03

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

L – 45; T – 15

REFERENCES :

1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th Edition, 2012.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design – The Hardware / Software Interface, 4th Edition, Morgan Kaufmann, Elsevier, 2009.
3. D.Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.
4. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Addison Wesley, 2nd Edition, 2004.
5. B. Govindarajalu, "Computer Architecture and Organization", Tata McGraw Hill Education Pvt. Ltd., 2010.

OUTCOMES :

Students who complete this course will be able to

- Suggest the requirements for a new instruction set, to meet the functional requirement and to contribute to performance.
- Test the performance of a computer system
- Analyze changes in performance with various configurations and Memory Hierarchy
- Analyze code for instruction level Parallel Processing and modify the code for out of order execution for better performance
- Modify the code to exploit SIMD architecture and improve the performance of the system.
- Analyze how multi-threading in multiple processors and multi-core processors will share the resources for performance.

CSC6102   ALGORITHM DESIGN AND IMPLEMENTATION

L	T	P	C
3	0	2	4

OBJECTIVES :

- To discuss various algorithm design techniques for developing algorithms.
- To study the basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.
- To provide the basic knowledge of computational complexity, approximation and randomized algorithms.
- To learn the advanced techniques for designing algorithms, including dynamic programming, network flow and problem reduction
- To illustrate the NP completeness and identify different NP complete problems.
- To determine the time and space complexity of simple algorithms and recursively defined algorithms.

MODULE I   INTRODUCTION   09

Introduction and Motivation-Lower Bound-Asymptotic Notations-Mathematical Induction-Mathematical models-Formulating the Equations-Solving the equations-Homogeneous Linear Recurrence with Constant Coefficients-Non-homogeneous Equations-Transformations.

MODULE II   GRAPH ALGORITHMS   09

Elementary Graph Algorithms Breadth-first search- Depth-first search - Topological sort- Minimum Spanning Trees -The algorithms of Kruskal and Prim -Single-Source Shortest Paths - The Bellman-Ford algorithm - Single-source shortest paths in directed acyclic graphs -Dijkstra's algorithm -All-Pairs Shortest Paths -The Floyd-Warshall algorithm -Johnson's algorithm for sparse graphs- Maximum Flow-Flow network- The Ford-Fulkerson method- Maximum bipartite matching-Push-relabel algorithms-The relabel-to-front algorithm.

MODULE III   DIVIDE-AND-CONQUER AND RANDOMIZED ALGORITHMS   09

The maximum-sub array problem- Strassen's algorithm for matrix multiplication-The substitution method for solving recurrences-The recursion-tree method for solving recurrences-The master method for solving recurrences-Proof of the master theorem-The hiring problem- Indicator random variables-Randomized algorithms-Probabilistic analysis and further uses of indicator random variables.

MODULE IV   MULTITHREADED AND NUMBER-THEORETIC ALGORITHMS   09

The basics of dynamic multithreading-Multithreaded matrix multiplication Multithreaded merge sort-Elementary number-theoretic notions- Greatest common divisor - Modular arithmetic -Solving modular linear equations - The Chinese remainder theorem - Powers of an element- The RSA public-key cryptosystem- Primality testing-Integer factorization .

MODULE V   NP COMPLETENESS AND APPROXIMATION ALGORITHMS   09

Polynomial time-Polynomial-time verification-NP-completeness and reducibility-NP-completeness proofs-NP-complete problems- Approximation Algorithms-The vertex-cover problem-The traveling-salesman problem-The set-covering problem-Randomization and linear programming-The subset-sum problem.

L – 45; P – 30

REFERENCES :

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition MIT Press, ISBN:978-0262033848, 2009.
2. Alfred V Aho, John E Hopcrof, "The Design and Analysis of ComputerAlgorithms", Pearon Education,4th Edition, ISBN:978813170205, 2009.
3. Mark Allen Weiss," Data Structures and Algorithm Analysis in C++", Addison-Wesley,3rd edition, ISBN: 978-0132847377, 2013.

OUTCOMES :

Students who complete this course will be able to

- Prove the correctness of algorithms using inductive proofs and invariants.
- Analyze randomized algorithms with respect to expected running time, probability of error using tail inequalities
- Classify problems into different complexity classes corresponding to both deterministic and randomized algorithms
- Analyze approximation algorithms including algorithms that are PTAS and FPTAS.
- Implement both a greedy and a divide-and-conquer algorithm to solve problems.

- Design the techniques of proof by contradiction, mathematical induction and recurrence relation, and apply them to prove the correctness and to analyze the running time of algorithms.

CSC6103	COMPUTER NETWORKS AND MANAGEMENT	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To outline the basic concepts of computer networks
- To illustrate the operations of network traffic, congestion, controlling and Queuing delay models
- To compare different mechanism for Quality of Service and Internet protocols
- To describe the concept and architecture of Network Management
- To showcase the different network management protocols like SNMP and RMON
- To identify various network tools to simulate the working of connection oriented and connectionless networks.

MODULE I   INTRODUCTION TO COMPUTER NETWORKS   09

Introduction – Reliable Transmission via Redundancy – Reliable transmission by retransmission - Routing and addressing – Link Layer Protocols and Technologies – Quality of Service overview

MODULE II   TRANSMISSION CONTROL PROTOCOL (TCP) AND SWITCHING AND QUEUING DELAY MODELS   09

Introduction to UDP and TCP – User Datagram Protocol (UDP) – TCP and Reliable Byte Stream Service – Congestion Control – Fairness – Recent TCP Versions – TCP Wireless Links - Packet Switching in Routers - Queuing Model – Networks of Queues

MODULE III   MECHANISMS FOR QUALITY OF SERVICE AND INTERNET PROTOCOLS   09

Queue Scheduling – Policing – Active Queue Management – MPLS - Internet Protocol Version (IPV6) – Routing Protocols – Address Translation Protocols – Domain Name System (DNS) – Network Management Protocols – Network Tools

MODULE IV   NETWORK MANAGEMENT AND SNMP   09

Network Management : goals , Organization and Functions – Network Management Architecture and organization – Network Management perspective – NMS platform – Current Status & future of Network Management – SNMP V1 Network Management- Basic Foundation standards, Models and languages –

Organization and information Models - Communication and functional Models – SNMP V2 – SNPV3

MODULE V   RMON, NETWORK MANAGEMENT TOOLS AND APPLICATIONS   09

Remote Monitoring – RMON SMI & MIB – RMON1-RMON2-ATM Remote Monitoring – A Case Study of Internet Traffic using RMON – Network Management Tools, Systems and Engineering – System utilities for Management – Network Statistics Measurement Systems – MIB Engineering – NMS Design – Network Management Applications.

L-30; P-30

REFERENCES :

1. Ivan Marsic , "Computer Networks Performance and Quality of Service" , Rutgers University, New Brunswick, New Jersey, 1st edition, FREE PDF, ISBN-10: N/A, http://www.ece.rutgers.edu/~marsic/books/CN, 2013.
2. Mani Subramanian "Network Management : Principles and Practice ",2nd edition, Pearson Edition, ISBN-13: 978-8131734049, 2010.
3. Olivier Bonaventure, "Computer Networking : Principles, Protocols and Practice", Creative Commons Attribution , ISBN: 978-1-365-18583-0, 2011.
4. Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition, Elsevier , ISBN-13: 978-0123850591, 2014.
5. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI, ISBN-13: 978-0136085300, 2014.

OUTCOMES :

Students who complete this course will be able to
- Describe the network services, protocols and architectures
- Identify the different congestion control techniques
- Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Apply SNMP and RMON for Managing Network.
- Access MIBS from devices using SNMP on a workstation
- Analyze and interpret the data provided by an NMS and take suitable actions

CSC6104   DISTRIBUTED OPERATING SYSTEM   L   T   P   C
                                                  3   0   0   3

OBJECTIVES :

- To obtain an in depth knowledge of the aspects of operating systems such as process management, scheduling, synchronization.
- To give an insight into remote procedure calls and distributed systems.
- To outline the distributed scheduling and shared memory concepts.
- To provide a concise overview of distributed resource management.
- To outline the approaches of fault recovery and the issues.
- To give an emphasis on the resource security and protection.

MODULE I   PROCESS SYNCHRONISATION   09

Overview – synchronization mechanism-Critical Section Problems-Language mechanism for Synchronization -Process Deadlocks-Models of Deadlock and Resources-Graph Theoretic Model of a system state- Systems with single unit requests-consumable –reusable resources .

MODULE II   DISTRIBUTED SYSTEMS   09

System architecture types-Distributed architecture systems -issues in distributed operating systems-communication networks-primitives-Theoretical Foundations-inherent limitation of distributed systems-Lamport's Logical clocks- distributed mutual exclusion: classification of mutual exclusion algorithms, Lamport's ,token based algorithm, Suzuki-Kasami's Broadcast algorithm, Raymond's Tree based algorithm, Distributed deadlock detection.

MODULE III   DISTRIBUTED RESOURCE MANAGEMENT   09

Distributed File Systems – Architecture – Mechanisms – Design Issues - Distributed Shared Memory – Distributed Scheduling – Case Studies.

MODULE IV   FAULT TOLERANCE AND RECOVERY   09

Classification of failures-Backward and forward error recovery – Basic approaches – Recovery in concurrent systems – Synchronous and Asynchronous check point and recovery – Fault tolerance- Issues-Atomic actions and committing-Commit protocols-voting protocols.

MODULE V   SECURITY   09

Security Environment - Operating System Security - Controlling Access to Resources – Formal Models of Secure Systems - Cryptography as a Security Tool – Authentication-Exploiting Software – Attacks-Malware – Defenses.

Theory : 45

REFERENCES :

1. Mukesh Singhal and Niranjan. G. Shivaratri, "Advanced Concepts in Operating Systems", McGrawHill, 2011.

2. Andrew S.Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson,ISBN 978-0-13-359162-0, 2015.

3. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", 9th Edition, Addison Wesley Publishing Co., ISBN – 978-1-11-809375-7, 2012.

4. William Stallings, Moumita Mitra Manna "Operating Systems – Internal and Design Principles, 8th Edition, Pearson Education, ISBN 978-0-13-380591-8, 2014.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate operating system concepts such as scheduling and synchronization.

- Identify the design and implementation issues with distributed systems.

- Evaluate the scheduling requirements of distributed systems and find their solutions

- Identify the different approaches to fault recovery and the fault tolerance issues.

- Apply methods and tools for resource protection and security.

- Investigate different operating system principles, abstractions, algorithms and techniques.

CSC6105	ADVANCED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To expose students to social, legal and ethical issues for Software Engineers.
- To provide experience using an agile like process.
- To expose development of software systems of high quality.
- To demonstrate the necessary understanding of methods and techniques for software management.
- To accumulate knowledge of the analysis, design and management of large and complex software systems.
- To develop the ability to understand, design and implement such systems in the global market.

MODULE I   INTRODUCTION   09

Professional Software Development – Software Engineering Ethics – Case Study – Software Process Models – Process Activities – Agile Process Development – Requirement Engineering – System Modeling – Architectural Design – Implementation – Testing.

MODULE II   SYSTEM DEPENDABILITY AND SECURITY   09

Dependable Systems Dependability Properties – Sociotechnical Systems – Dependable Process – Formal Methods and Dependability – Reliability Engineering   Reliability Requirements – Fault tolerant Architectures – Reliability Measurement – Safety Engineering – Security Engineering.

MODULE III   ADVANCED SOFTWARE ENGINEERING   09

Software Reuse – Reuse Landscape – Application Framework Application System reuse – Component Based Software Engineering Componenets and Components models – CBSE Processes – Component composition – Distributed Software Management.

MODULE IV   SOFTWARE ORIENTED SOFTWARE ENGINEERING   09

Service Oriented Architecture – RESTful services – Service Engineering – Service Composition – Systems Engineering – Systems of Systems – Real Time Software Engineering – Embedded System Design – Architectural Patterns for real-time Software – Time Analysis – Real-Time Operating Systems.

MODULE V   SOFTWARE MANAGEMENT   09

Project Management – Project Planning – Software Pricing – Plan Driven development – Projevct Scheduling – Agile planning – Estimation Techniques – COCOMO Testing Modeling – Quality Management – Configuration management.

Theory : 45

REFERENCES :

1. Ian Sommerville, Software engineering, Pearson education Limited, 6th edition, ISBN : 978-1-292-09613-1,2016.
2. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw- Hill International Edition, 8th edition,ISBN-13: 978-0-0780-2212-8, 2014.
3. Dogru, Ali H., Modern Software Engineering Concepts and Practices: Advanced Approaches: Advanced Approaches, IGI Global, ISBN: 978-1-60960-215-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Expose technical issues through a software development project.
- Analyze the impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues;
- Design models to reflect abstract architectures of software systems.
- Create and understand descriptions of SOA using high level UML models
- Apply the Software Engineering concepts to Software Projects in a real business environment.
- Evaluate research articles and thus be aware of the research front in software development.

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I   RESEARCH PROBLEM FORMULATION   07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II   HYPOTHESIS FORMULATION   08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III   STATISTICAL TECHNIQUES   12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV   STATISTICAL ANALYSIS OF DATA   10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V   RESEARCH REPORT   08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing –

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graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Theory : 45

REFERENCES :
1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., "Genetic Algorithms for optimization", KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, "How to write a Ph.D. Thesis" Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOMES :
Students who complete this course will be able to
- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

			L	T	P	C
CSC6201	**MACHINE LEARNING TECHNIQUES**		**2**	**0**	**2**	**3**

OBJECTIVES :

- To expose the applications of machine learning.
- To study the various algorithms related to supervised and unsupervised learning.
- To recognize the different types of machine learning models and how to use them.
- To learn the theoretical and practical aspects of probabilistic graphical models.
- To acquire the knowledge of various classification techniques.
- To learn the various neural network algorithms.

MODULE I   INTRODUCTION TO MACHINE LEARNING   09

Introduction - examples of machine learning applications - Types of machine learning- Mathematical foundations of machine learning– Introduction to Parametric Models – Non-Parametric Models –Probability Basics.

MODULE II   SUPERVISED LEARNING   09

Linear Models for Regression – Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison - Limitations of Fixed Basis Functions - Linear Models for Classification – Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Neural Networks – Network Training - Feed-forward Network Functions – Back Propagation Network – Bayesian Neural Network.

MODULE III   UNSUPERVISED LEARNING   09

Clustering- K-means - EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA - Independent components analysis - Singular Value Decomposition.

MODULE IV   PROBABILISTIC GRAPHICAL MODELS   09

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models -Bayesian Networks - Conditional independence properties - Inference – Learning - Generalization - Hidden Markov Models - Conditional random fields.

MODULE V   APPLICATIONS   09

Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks – Case Study.

L-30; P-30

REFERENCES :

1. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 1st edition, ISBN-13: 978-0387-31073-2, 2006.
2. Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, MIT Press, ISBN:9780262028189, 2014.
3. Kevin Patrick Murphy , "Machine Learning: a Probabilistic Perspective", 4th edition, MIT Press, ISBN:9780262018029, 2013.
4. Drew Conway, John Myles White, "Machine Learning for Hackers",1st Edition, O'Reilly Media, 2012.
5. Ian H. Witten, Eibe Frank, Mark A. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Edition, Morgan Kaufmann, 2011.

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.
- Develop skills of using recent machine learning software for solving practical problems.
- Analyze the efficient clustering techniques for solving real world problems.
- Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
- Apply the appropriate techniques in social network analysis and Web Security.

CSC6261   STATISTICS FOR BUSINESS ANALYTICS   **L T P C**
                                                          3 1 0 4

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 study the association between categorical and numerical data.
- To identify and build appropriate statistical regression models.
- To validate the built regression models.

MODULE I   INTRODUCTION   09
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 – Box plot - Shape of a Distribution.

MODULE II   ASSOCIATION IN CATEGORICAL AND NUMERICAL DATA 09
Contingency Tables -Lurking Variables and Simpson's Paradox - Strength of Association – Scatter plots - Association in Scatter plots - Measuring Association - Summarizing Association with a Line - Spurious Correlation.

MODULE III   PROBABILITY   09
Probability - Conditional Probability - Random Variables - Association between Random Variables - Probability models for Counts - Normality – Managing Financial Risk -Modeling Sampling Variation.

MODULE IV   INFERENCE   09
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 & II   09
Linear Patterns - Curved Patterns - Simple Regression – Regression Diagnostics - Multiple Regressions - Building Regression Models - Categorical Explanatory Variables - Analysis of Variance - Time Series.

L – 45; T – 15

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, 8th edition, 2013.

3. Keller Gerald, "Statistics for Management and Economics", Cengage Learning, 10th 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.

- Find the difference between various regression models.

- Infer the approaches available for data comparison.

SEMESTER III

CSC7162   BIG DATA ANALYTICS   **L   T   P   C**
                                                        3   0   0   3

OBJECTIVES :

- To formulate the difference between Big data and Data Analytics.
- To address the phases of Data Analytics life cycle through case study .
- To provide the students with the conceptual knowledge of Big Data.
- To get familiarized with the analytical methods.
- To explore validation and testing methods for decision making.
- To gain knowledge on the tools such as R, MapReduce and hadoop.

MODULE I   BIG DATA ECO SYSTEM   09

Big Data Overview - Data Structures - Analyst Perspective on Data Repositories -   State of the Practice in Analytics - BI Versus Data Science - Current Analytical Architecture - Drivers of Big Data - Emerging Big Data Ecosystem and a New Approach to Analytics - Key Roles for the New Big Data Ecosystem - Examples of Big Data .

MODULE II   DATA ANALYTICS LIFECYCLE   09

Discovery - Data Preparation -   Model Planning – Model Building - Communicate Results - Operationalize   Case Study.

MODULE III   ANALYTICAL THEORY AND METHODS I   09

Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions - - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing - Diagnostics .

MODULE IV   ANALYTICAL THEORY AND METHODS II   09

Linear Regression - Logistic Regression - Reasons to Choose and Cautions - Decision Trees - Naïve Bayes - Bayes' Theorem - Naïve Bayes Classifier - Diagnostics of Classifiers.

MODULE V   INTRODUCTION TO R   09

Introduction to R - R Graphical User Interfaces - Data Import and Export - Attribute and Data Types - Descriptive Statistics - Exploratory Data Analysis - Visualization

Before Analysis - Analytics for unstructured data – MapReduce, Apache Hadoop – Hadoop Ecosystem – Pig – Hive – Hbase – Mahout – NoSQL.

Theory : 45

REFERENCES :

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley, ISBN: 978-1-118-87613-8, 2015.
2. Peter Bühlmann, Petros Drineas, Michael Kane, Mark van der Laan, "Handbook of Big Data", CRC Press, 2016.

OUTCOMES :.

Students who complete this course will be able to

- Address the principles of Big Data and its difference to Data Analytics.
- Describe the life cycle phases of Data Analytics through discovery , planning and building.
- Demonstrate the analytical techniques used in decision making.
- Employ tools and technologies to analyze Big data.
- Apply R tool for developing real time applications
- Develop applications using Hadoop

PROFESSIONAL ELECTIVES

LIST OF ODD SEMESTER ELECTIVES

CSCY102	AGENT BASED INTELLIGENT SYSTEMS	L	T	P	C
		1	0	2	2

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.
- To study the employment of artificial intelligence in recent technologies.
- To represent knowledge in first order and predicate logic.
- To learn about machine learning and planning agent.

MODULE I   INTRODUCTION   15

Introduction to Artificial Intelligence – Problem solving with AI – CSP - Representation of knowledge using Logic and Rules - Uncertain knowledge and reasoning – Probabilistic reasoning - Types of Agent - Multi Agent Planning - Multi Agent Based Learning - Architecture of expert system - Natural Language Processing – Fuzzy and hybrid Intelligence system –Cloud Computing and Intelligent Agents – Business Intelligence and Analytics – Big Data and Sensory Processing.

MODULE II   INTELLIGENT AGENT   15

Problem Solving: Travelling Salesperson problem, Tower of Hanoi, Tic-Tac-Toe, Water Jug Problem. Creation of agents - Defining their behavior - Observe behavior. Visualization of agent based models. Creating Interface for Robots and Sensors.

L-15; P-30

REFERENCES :

1. ParagKulkarni, Prachi Joshi, "Artificial Intelligence: Building Intelligent Systems, 1st Edition, PHI, ISBN: 978-81-203-5046-5, 2015.

2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, ISBN-13: 978-0136042594, 2010.

3. NgoocThanhNguyaaen, Lakhmi C. Jain, "Intelligent Agents in the Evolution of Web and Applications", 4th Edition, Springer, 2009.

4. ZiliZhang,Chengqi Zhang, "Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving", 1st Edition, Springer-Verlag New York, LLC , 2004.

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.
- Explore the scenarios of uncertainty and design planning agents to handle them.
- Ability to apply the tools in knowledge representation and reasoning for real-world problems.
- Apply Artificial Intelligence techniques in the cutting edge technologies such as cloud computing and Big data.
- Design knowledge based agents for challenging environment.
- Explain the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.

CSCY125   RISK ANALYSIS AND MANAGEMENT   L   T   P   C
                                                  3   0   0   3

OBJECTIVES :

- To realize project risk management system through which project risk can be identified, evaluated and managed.
- To know the different risks and impacts of risk.
- To demonstrate tools and techniques used to identify and assess project risk.
- To elaborate risk management framework.
- To discuss the various risk design strategies
- To study how to effectively process the risk protocols

MODULE I   INTRODUCTION TO RISK ANALYSIS   08

Introduction–Risk analysis – Types of risks – Classification Systems – Impact of risk on organization – Risk and uncertainty.

MODULE II   RISK MANAGEMENT   09

Origins of risk Management – Enterprise risk management – Levels of risk management – Risk maturity models – Principles of risk management–Risk management activities – Implementing risk management.

MODULE III   STANDARDS OF RISK STRATEGY   09

Risk management process – Framework – COSO ERM cube – Features of RM standards – control environmental approach - Risk management policies and protocols.

MODULE IV   RISK ORGANISATION   10

Range of Responsibilities – Role of risk manager – risk architecture – risk communications – risk aware culture – measuring risk culture – risk training - risk management information systems.

MODULE V   CASE STUDY   09

Invensys- risk and organizations – corporate governance model- stakeholder's expectations –analysis of business model-project risk management – operational and supply chain management.

Theory : 45

REFERENCES :

1. Paul Hopkin, "Fundamentals of Risk Management- Understanding, evaluating and implementing effective risk management", 1st Edition, IRM Publishers, Kogan Page Limited, ISBN 978-0-7494-5943-7, 2010.

2. John Bartlet, "Project Risk Analysis and Management Guide", 2nd Edition, ARM Publishing Ltd, ISBN 1-903494-12-5, 2004.

OUTCOMES :

Students who complete this course will be able to

- Describe the concepts of various risk management
- Identify, formulate and solve engineering problems in risk management
- Analyze the need of risk communication in the organizations
- Develop different risk design strategies
- Apply knowledge of mathematics, science and engineering to the assessment of risk
- Implement tools and techniques to evaluate risk in project

CSCY161	SOCIAL MEDIA MINING	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To expose the Social media and related concepts
- To recognize the procedures for community classification
- To experiment with social media data extraction and analysis
- To analyze the challenges in social media mining
- To practice mining contents in various social media
- To expose the Social media and related concepts

MODULE I   RUDIMENTS OF SOCIAL MEDIA MINING   09

Key concepts of social media mining-Good data verses bad data-Understanding sentiments-Scherer's topology of emotions-sentiment polarity-data and classification-Supervised social media mining: Lexicon-based sentiment-Naive Bayes Classifiers-unsupervised social media mining-Item response Theory for text scaling.

MODULE II   COMMUNITY ANALYSIS AND INFORMATION
DIFFUSION   09

Community Detection: Community Detection-Member based community detection-Group based community detection-Community evolution-network evolution-detecting community in evolving networks-community evaluation-Diffusion:-Herd Behavior-Information Cascades-Diffusion of innovations-Epidemics.

MODULE III   APPLICATIONS   09

Measuring Assortativity-Influence-Homophily-Distinguishing Influence and Homophily Recommendations in social Media-Challenges-Classical Recommendation algorithms-Recommendation using Social Context- Behavior Analytics: Individual Behavior-Collective Behavior.

MODULE IV   POTENTIALS AND PITFALLS OF SOCIAL MEDIA   09

Opinion mining made difficult-sentiment and its measurement-The nature of Social Media-Traditional verses nontraditional social data-Measurement and inferential challenges-Case study: Supervised social media mining-lexicon based sentiment-Naive Bayes Classifier-IRT models for unsupervised sentiment scaling.

MODULE V   MINING THE SOCIAL MEDIA   09

Mining   twitter-Mining   facebook-Mining   LinkedIn-Mining   Google+-Mining
Mailboxes-Mining GitHub-Mining the semantically marked-up web.

L-30; P-30

REFERENCES :

1. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, ISBN: 9781107018853, 2014.
2. Richard Heimann, Nathan Danneman, "Social Media Mining with R", Packt Publishing, ISBN : 1783281774, March 2014.
3. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+.GitHub and more..",O'Reilly Media, Second edition, ISBN: 9781449388348, 2013.

OUTCOMES :

Students who complete this course will be able to

- Apply data mining techniques in social media.
- Analyze and mine emotions in social media.
- Classify communities in social media.
- Apply the social media mining concepts to real world situations and derive useful Knowledge.
- Infer the challenges in social media mining.
- Predict the significance of social media and its impact in the real time scenarios.

CSCY162   WEB ANALYTICS

L	T	P	C
2	0	2	3

OBJECTIVES :
- To provide overview and the need for web analytics.
- To expose to the fundamentals how web analysis.
- To give the measuring strategy and effects of web analytics
- Identify the various types of testing and reporting methods.
- To describe the metrics to analyze the web data.
- To provide exposure to usage of web analytic tools.

MODULE I   INTRODUCTION TO WEB ANALYTICS   10
Web analytics approaches –Web analytics works: page tagging, metrics and dimensions, Interaction with data- Goals

MODULE II   WEB ANALYTICS   09
Learning about user through web analytics: Visitor Analysis – Traffic analysis – Analyzing how people use you content – Click-path analysis.

MODULE III   MEASURING THE EFFECTS   09
Segmentation – Paring the data with UX methods – Measuring the effects of changes: types of changes. Measuring behavior within pages.

MODULE IV   TESTING AND REPORTING   08
A/B Testing - Analysis report- Regular reporting and talking to stack holders: Reporting culture, Making usability activities -Web analytics in future.

MODULE V   APPLICATIONS AND TOOLS   09
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.

L-30; P-30

REFERENCES :

1. Michael Beasley "Practical Web Analytics for User Experience" ,Elsevier ,ISBN :978-0-12-404619-1,2013.
2. Brian Clifton, "Advanced Web Metrics with Google Analytics", 3rd Edition, Sybex , ISBN-10: 1118168445 , 2012.

OUTCOMES :

Students who complete this course will be able to

- Explore Knowledge in web data.
- Demonstrate different methodologies to perform analysis and improve the performance of web pages
- Trace the concept of measuring strategy in web analytics
- Describe the knowledge of various types of testing
- Study real-time websites for enhancing business performance.
- Develop real time applications using various tools.

CSCY163   CLUSTER ANALYSIS

	L	T	P	C
	3	0	0	3

OBJECTIVES :

- To provide insights into the theoretical foundations behind varied methods of clustering techniques.
- To expose students to graphical cluster detection approaches.
- To provide knowledge about the optimization clustering algorithms
- To discuss applicability of clustering in different fields.
- To describe varied measures for different type of data in clustering
- To establish fundamental foundation models of clustering

MODULE I   CLASSIFICATION AND CLUSTERING   07

Classification vs Clustering - Defining a cluster –Applications of clustering : Market research - Astronomy - Psychiatry - Weather classification - Archaeology - Bioinformatics and Genetics.

MODULE II   GRAPHICALLY DETECTING CLUSTERS   10

Clusters detection with univariate and bivariate plots of data – Histograms – Scatterplots - Density estimation - Scatterplot matrices – Multivariatre Dara Projections – PCA- Exploratory Projection Pursuit - Multidimensional scaling - Three-dimensional plots and trellis graphics.

MODULE III   PROXIMITY MEASURES   10

Similarity Measures for categorical data - categorical data with more than two levels – Data containing both continuous and categorical variables - Dissimilarity and distance measures for continuous data - Proximity measures for structured data - Inter-group proximity measures - Weighting variables – Standardization - Choice of proximity measure.

MODULE IV   HIERARCHICAL CLUSTERING TECHNIQUES AND
OPTIMIZATION   09

Introduction - Agglomerative methods - Divisive methods - Applying the hierarchical clustering process - Applications of hierarchical methods - Clustering Criteria – Optimization Algorithms - Applications of optimization methods.

MODULE V   CLUSTER MODELS   09

Finite mixture densities - Bayesian analysis of mixtures - Inference for mixture models - Dimension reduction - Finite regression mixtures - Application of finite

mixture densities - Finite mixture models for structured data – Factor Models – Longitudinal Models - Applications of finite mixture models - Miscellaneous clustering methods.

Theory : 45

REFERENCES :

1. Brian S. Everitt, Sabine Landau, Morven Leese, and Daniel Stah, "Cluster Analysis", 5th Edition ,Wiley, ISBN : 978-0470749913, 2011.
2. Sugato Basu, Ian Davidson, Kiri L.wagsstaff, "Constrained Clustering: Advances in Algorithms, Theory, and Applications", 1st Edition, Chapman and Hall/CRC press, ISBN: 978-1584889960, 2008.

OUTCOMES :

Students who complete this course will be able to
- Discriminate between clustering and classification problems.
- Acquire the capability identify need for cluster analysis different domains
- Identify clusters in data using graphic cluster detection techniques
- Apply suitable proximity/similarity measures for clustering.
- Appraise varied clustering methods/models and identify the suitable one for a given problem.
- Recognize the need for optimization algorithms.

CSCY164	MARKET ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the principles and strategic concepts of marketing analytics.
- To identify varied approaches for market segmentation and competitive analysis
- To expose business strategy development process
- To get an overview of the varied aspects of product pricing
- To showcase different analytics concepts which support varied aspects for market analytics
- To create awareness of issues pertinent to distribution , promotion and sales related analysis.

MODULE I   INTRODUCTION   09

Introduction to Marketing Analytics – Models & Metrics – Market Insight – Terminologies – Data Sources - Market sizing - PESTLE analysis.

MODULE II   MARKET SEGMENTATION AND ANALYSIS   09

Market segmentation – Segment Targeting and Positioning- Competitor identification and information gathering – Competitive analysis – Competitive actions.

MODULE III   BUSINESS STRATEGY AND OPERATIONS   09

Business Strategy – Strategic Scenarios – Strategic Decision Models - Strategic Metrics- Business Operations - Forecasting, predictive analytics, and data mining.

MODULE IV   PRODUCT, SERVICE AND PRICE ANAYTICS   09

Conjoint analysis – Decision Tree Model- Resource Allocation - Product/service metrics, Pricing techniques and assessment – Profitable pricing –Pricing for business markets – Price Discrimination.

MODULE V   DISTRIBUTION, PROMOTION and SALE ANALYTICS   09

Distribution Channel characteristics – channel evaluation, selection and Metrics Promotion budget estimation and allocation – promotion metrics for traditional and social media Sales Process – Ecommerce Sales Model – Sales Metrics – Profitability metrics- Support Metrics.

Theory : 45

REFERENCES :

1. Stephan Sorger, "Marketing Analytics: Strategic Models and Metrics", 1st Edition, Create Space Independent Publishing Platform, ISBN :1481900307, 31-Jan-2013.

2. Stephan Sorger, "Marketing Planning: Where Strategy Meets Action", 1st Edition, Prentice Hall PTR, ISBN-10: 0132544709, 03-Sep-2011.

3. Cesar A.Brea, "Pragmalytics : Practical approaches to the Marketing analytics in the Digital Age",1st Edition, iUniverse, , ISBN: 9781475959567, 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 metric
- Evaluate and choose appropriate marketing channel
- Determine the costing and profitability factors associated with chosen strategy

CSCY165	TEXT ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the basics of text analysis.
- To trace the areas of text analytics.
- To describe the concept of clustering in text mining.
- To acquire the knowledge predictive model
- To analyze the future of text analytics
- To illustrate the domains that makes up text analytics and web analytics.

MODULE I   INTRODUCTION TO TEXT MINING   09

Roots of text mining - Information extraction and text mining - Development of enabling technology in text mining - Sentiment analysis and opinion mining. Definition - Business challenges addressed: information organization and access - Discovery of patterns.

MODULE II   TEXT ANALYTICS   10

Text analytics and text mining - Future of text mining - Practice areas of text analytics - Finding the appropriate solution to a problem - Visualizing the domains of text analytics.

MODULE III   CLUSTERING   09

Text Capturing, sorting, sifting, stemming and matching – word cloud, wordless and beyond –Clustering document using words – sentiment and counting

MODULE IV   PREDICTIVE MODEL   09

Word regression – Classification that grow on trees: CHAID and CART applications – Bayes Nets.

MODULE V   APPLICATIONS AND TOOLS   08

Application of text mining - Case study – Limitations of Google analytics.

Theory : 45

REFERENCES :

1. Gary Miner John Elder IV, Robert Nisbet, DursunDelen, Thomas Hill, Andrew Fast, "Practical Text Mining and Statistical Analysis for Non-

structured Text Data Applications",1st Edition, Academic Press, ISBN-9780123869791,2012.

2. Steven Struhl,"Practical Text Analytics: Interpreting text and unstructured data for business intelligence", ISBN : 0749474025, 2015.

3. Brian Clifton Sybex, "Advanced Web Metrics with Google Analytics", 3rd Edition, Pearson education, ISBN: 978-1-118-16844-8, 2012.

OUTCOMES :

Students who complete this course will be able to

- Relate text mining to analytics.
- Recognize the knowledge about text mining and text analytics.
- Explore the domains of text analytics according to user's view.
- Describe the knowledge on clustering in text analysis.
- Predict the future using of text analytics.
- Analyse the techniques for text and web analytics.

CSCY166   GAMING ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To give introduction on basics of gaming analytics.
- To provide information on game data analysis
- To analyze using metrics visualization.
- To focus on mixed methods for game evaluation.
- To explain about game analytics for learning and education.
- To design game framework for players.

MODULE I   INTRODUCTION   09

Game Analytics: Basics-Benefits of game analytics-Game industry metric terminology -Telemetry collection and tools- Game development telemetry in production.

MODULE II   GAME DATA ANALYSIS AND METRICS   09

Game data mining -Game play metrics-Metrics Visualization - Spatial game analytics - Visual game analytics-Visual analytics tools.

MODULE III   MIXED METHODS FOR GAME EVALUATION   09

Contextualizing data -Game metrics through questionnaire - Visual attention and gaze behavior in games -Psychological player metrics for evaluating games-Improving game play through game metrics and player metrics.

MODULE IV   METRICS AND LEARNING   09

Metrics in Simulation and Game for learning -Serious game analytics -Serious game analytics for medical learning-Serious game analytics for learning and education- Case studies.

MODULE V   DESIGN SHOWCASES   09

Metrics for better puzzles - Design and implementation of game telemetry in serious game analytics- Game design methodology for generating psychological profiles of players -Replay analysis in open ended educational games -Measure affects in player-Access game play.

Theory : 45

REFERENCES :

1. Magy Seif El Nasr, Anders Drachen, Alessandro Cannosa, "Gaming analytics: Maximizing the value of player data", ISBN 1447147685, Springer, 2013.

2. Christian Sebastian Loh, Yanyan Sheng, Dirk Ifenthaler, " Serious gaming analytics: Methodologies for performance measurement, assessment and improvement", ISBN 3319058347, Springer, 2015.

OUTCOMES :

Students who complete this course will be able to

- Explain the basics of gaming analytics.
- Analyze the gaming data using the metrics associated with it.
- Evaluate game and player using mixed methods.
- Use serious game analytics for various strategies.
- Apply metrics for learning and education.
- Design and implement gaming for psychological players.

MAC6195	MULTIPLE LINEAR REGRESSION	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   08

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

MODULE II   LINEAR MODELS AND LEAST SQUARES   08

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   07

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   08

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   07

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   07

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.

Theory : 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.

LIST OF EVEN SEMESTER ELECTIVES

CSCY204   ADVANCED DATABASES

L T P C
3 0 0 3

OBJECTIVES :

- To comprehend the different issues involved in the design and implementation of a database system
- To analyze the physical and logical database designs.
- To explore the database modeling, relational and object oriented models.
- To describe the techniques involved in the design of distributed databases.
- To recognize the various database techniques used in cloud and big data applications.
- To develop an understanding of emerging DBMS for various applications

MODULE I   ADVANCED SQL QUERIES AND DATABASE TUNING   08

Relational model conformity and Integrity- Advanced SQL programming- Query optimization- Concurrency control and Transaction management- Database performance tuning-Distributed relational systems -Security issues in Databases.

MODULE II   THE EXTENDED ENTITY RELATIONSHIP MODEL AND OBJECT MODEL   09

The ER model-Motivation for complex data types-User defined abstract data types and structured types- Subclasses- Super classes- Inheritance-Specialization and Generalization-Constraints and characteristics of specialization and Generalization-Relationship types of degree higher than two.

MODULE III   DISTRIBUTED DATABASES   10

Distributed Systems- Parallel Databases: I/O Parallelism -Inter and Intra Query Parallelism -Inter and Intra operation Parallelism- Design of Parallel Systems. Distributed Database Concepts- Distributed Data Storage -Distributed Transactions -Commit Protocols - Concurrency Control -Distributed Query Processing - Case Studies.

MODULE IV   INTRODUCTION TO CLOUD DATABASES AND BIG DATA 09

Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis. Batch computing models for Big Data computing- Key-value

storage systems -- Scalable prediction models - Distributed file systems - Scalable data analytics-- Data models – Real time data stream analytics.

MODULE V   EMERGING DATABASE MANAGEMENT SYSTEM TECHNOLOGIES   09

Object Oriented database concepts-Object Relational database concepts-Active database concepts; Temporal database concepts-Spatial database concepts and architecture- Deductive databases and Query processing- Mobile Databases-Geographic Information Systems. Multimedia Databases; Multidatabases- Native XML databases (NXD)-Genome Data management.

Theory : 45

REFERENCES :

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fifth Edition, McGraw Hill, 2011.
2. Jeff Hoffer, Ramesh Venkataraman, HeikkiTopi, "Modern Database Management Systems", Pearson Education Limited, 12th edition, ISBN:9781292101866, 2016.
3. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 6th edition, Pearson Education, ISBN: 13 : 978-0132943260, 2014.
4. Carlos Coronel and Steven Morris, "Database Systems: Design, Implementation, & Management", Cengage Learning, 12th edition, ISBN-13: 9781305627482, 2016.

OUTCOMES :

Students who complete this course will be able to

- Define the terminology, features, classifications, and characteristics in database systems.
- Illustrate the design strategies, query processing techniques and algorithms for advanced databases.
- Analyze an information storage problem and derive at an appropriate data model for the problem.
- Assess the Database techniques for designing intelligent information retrieval system for any application.
- Describe the database techniques used in Cloud and Big data environment.
- Appraise the emerging technologies in Databases and propose suitable model for any given application

CSCY212   XML AND WEB SERVICES   L T P C
                                                      1 0 2 2

OBJECTIVES :

- To edify evolution of web services and their architecture.
- To describe, discover & develop web services.
- To inculcate in-built programming skill needed to provide a web service.
- To incorporate comprehensive introduction to the programming tools required to build and maintain websites
- To facilitate how to build XML applications with DTD and style sheets.
- To practice the technologies in building the web services.

MODULE I   INTRODUCTION   15

Introduction to XML-Name spaces –Schema - Web Services - Web Service Technologies - Web Services Architecture – SOAP – WSDL – UDDI – Standards - Service Coordination Protocols – Infrastructure - WS-Coordination – WS-Transaction – RosettaNet – xCBL – ebXML – WSCI - Service Composition - Exception Handling - Business Process Execution Language for Web Services.

MODULE II   BUILDING WEB SERVICES   15

Introduction to ASP.NET Web API - Managing a Web API - Connecting Applications-Creating a Web API using Mobile Services - Creating Hybrid Services - Data services in Cloud: Data and Access Technologies - Creating Data Source for Web Application.

L-15; P-30

REFERENCES :

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, "Web Services: Concepts, Architectures and Applications",Springer,ISBN: 3662108763, 2013.
2. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser, "Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World", Springer, ISBN:978-3-642-62468-1, 2012.
3. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, "Building Web Services with Microsoft Azure", first edition, Packt publishing, ISBN: 978-1-78439-8, 2015.

OUTCOMES :

Students who complete this course will be able to

- Create web based application with the suitable markup languages like XML or HTML

- Develop database driven web applications using various web designing tools.

- Build and consume web services.

- Develop web service enabled applications.

- Use SOAP, WSDL & UDDI.

- Construct, deploy and call web services using the existing web technologies.

CSCY213	MULTIMEDIA SYSTEMS	L	T	P	C
		1	0	2	2

OBJECTIVES :

- To provide the basics of multimedia systems and processing of multimedia signals.
- To gain knowledge on multimedia tools and processes.
- To design multimedia systems in systematic approach.
- To produce information on user interface design.
- To identify the major applications of multimedia systems.
- To insight the research areas of multimedia systems.

MODULE I   MULTIMEDIA DESIGN   15

Mathematical Transforms used for multimedia signal processing- Digital Audio, image and video formats - Storing and Transmission of Digital audio signals – Visual Communication – Page layout – User interface design – Web design.

MODULE II   PROGRAMMING AND APPLICATIONS   15

Static Media - Text- Graphics-Photography-Time Based Media – Recording formats and Device settings – Audio production – Video production – Time based Editing- Interactive Multimedia- Digital Video Stabilization – Development of Architecture Information Archive and Multimedia formats for Digital E-libraries

L-15; P-30

REFERENCES :

1. Srdjan Stankovic, Irena Orovic, Ervin Sejdic, "Multimedia Signals and Systems: Basic and Advanced Algorithm for Signal processing", 2nd Edition, Springer , ISBN 978-3-319-23950-7, 2015 .
2. Vic Costello, "Multimedia Foundations: Core Concepts for Digital Design", 2nd Edition, CRC Press, ISBN 1317808908, 2016.
3. George A. Tsihrintzis, Maria Virvou, Lakhmi C. Jain, Robert J. Howlett, Toyohide Watanabe, "Intelligent Interactive Multimedia Systems and Services in Practice", Springer, ISBN 3319177443, 2015.

OUTCOMES :

Students who complete this course will be able to

- Construct mathematical transformations for multimedia signals.
- Analyse and process the multimedia signals such as images, audio, video.

- Acquire the basic concepts of multimedia tools and process in design.
- Illustrate design process of implementing multimedia systems.
- Use static and time based media in Multimedia system.
- Apply multimedia technology in various scenarios.

CSCY261   KNOWLEDGE DISCOVERY TECHNOLOGIES   L T P C
                                                    3 0 0 3

OBJECTIVES :

- To discuss Knowledge Discovery techniques/methods and their application.
- To help the students to extract useful knowledge from large volumes of data
- To expose to various issues, constraints and consideration in knowledge discovery process
- To make aware of industry standard processes involved in knowledge discovery
- To introduce newer paradigm like privacy preservation, real-time discovery and such others
- To explore applicability varied domains like healthcare, e-commerce, security, etc.

MODULE I   INTRODUCTION TO KNOWLEDGE DISCOVERY   09

Knowledge Discovery via Data Mining Process Models - Integrated Data Mining and Knowledge Discovery- Formulating the Business Objectives of Knowledge Discovery & Data Mining- Cross Industry Standard Process for Data Mining (CRSIP-DM)

MODULE II   ISSUES AND CONSIDERATIONS   09

Issues and considerations in the Application of Knowledge Discovery & Data Mining in Business - Data Quality Assurance in Data Analysis - A Context-Aware Framework for Evaluation of Data Mining Results – Domain Driven Data Mining and Knowledge Discovery - Success factors in Knowledge Discovery Process

MODULE III   DATA EXPLORATION   09

Construction and Exploration of Data – Integration of Data Mining and Statistical techniques for analysis – Incremental Learning Algorithms – Comparative study of Incremental Learning – Heuristics and Metaheuristics

MODULE IV   KNOWLEDEGE DISCOVERY TECHNIQUES   09

Multi-Relational Data Mining techniques – Online Processing of Real-Time & Near-Real time data – Data Stream Processing - Knowledge Extraction using Rough Computing

MODULE V   PRIVACY PRESERVATION   09

Privacy Preserving Knowledge Discovery Techniques – Case Studies – Applications in Commerce, Healthcare,   Cyber Security, Counter-Terrorism, Telecom, Agriculture

Theory : 45

REFERENCES :

1. Kweku-Muata Osei-Bryson, Corlane Barclay, "Knowledge Discovery Process and Methods to Enhance Organizational Performance", 1st Edition, Auerbach Publications, ISBN: 978-1482212365, 2015.
2. Muhammad Usman, "Improving Knowledge Discovery through the Integration of Data Mining Techniques", 1st Edition, IGI Global, ISBN: 9781466685130, 2015.
3. Francesco Bonchi, Elena Ferrari, "Privacy-Aware Knowledge Discovery: Novel Applications and New Techniques", 1st Edittion, CRC Press, ISBN: 9781439803653, 2010.

OUTCOMES :

Students who complete this course will be able to

- Acquire skills for applying knowledge discovery techniques
- Appraise both business and technical considerations in the context of applicable domains
- Deploy integrated methodologies and models for gain insights through knowledge discovery process
- Comparatively explore varied algorithms in the realm of knowledge discovery
- Identify and build models/methods for analysis
- Determine suitability of data models for different domain-specific analysis

CSCY262	CLASSIFICATION METHODS AND EVALUATION	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To learn the basics of pattern recognition techniques.
- To classify the data based on various classification techniques.
- To use the classification algorithms for huge data based applications to build better patterns
- To measure the dynamic change in datasets using mathematical methods
- To apply the same functions to different set of data sets.
- To compare with the similarity with neighour data sets.

MODULE I   PATTERN RECOGNITION SYSTEMS   08

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

MODULE II   BAYESIAN DECISION THEORY   10

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 THEORY   09

Introduction - Maximum-Likelihood Estimation - Bayesian Estimation - GaussianCase - General Theory - Problems of Dimensionality - Component Analysisand Discriminants - Expectation - Maximization - Hidden Markov Models

MODULE IV   NONPARAMETRIC TECHNIQUES   09

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   09

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

L-30; P-30

REFERENCES :

1. Richard O. Duda, Peter E. Hart, "Pattern Classification", 2nd Edition, John Wiley ISBN:111858600X, 2012.
2. Geoff Dougherty, "Pattern Recognition and Classification: An Introduction", 1st Edition, Springer, ISBN:1461453232, 2012.

OUTCOMES :

Students who complete this course will be able to

- Identify the pattern that is suitable for any particular field.
- Create a statistical system that tries to quantify the tradeoff between various decisions, making use of probabilities and costs.
- Recognize the best possible classification techniques based on requirements.
- Categorize the data using linear discrimination when the similarity is high .
- Apply the concepts to the real problems.
- Identify the sub patterns of the problem for easy handling of the complexity in the problem

CSCY263	PRECISION MARKETING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To help break down the perspectives, capabilities and skills necessary to deliver more powerful marketing results.
- To give the basic foundation for business Intelligence.
- 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, and applications are employing insight-driven marketing to deepen customer relationships and achieve profitable growth.
- To acquire the knowledge of design principles, guidelines and other fundamentals of marketing
- To evaluate the performance of a precision marketing system

MODULE I   PRECISION MARKETING JOURNEY   08

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   10

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 STRATEGIZE   10

Step three: Analyze and Model-The Segmentation Scale-Moving towards precision-The predictive Precision Marketer- Modeling for results - Step four: Strategize-Creating your customer strategy-The Communication Matrix-Strategy in action -Developing the right message-Measurable content-Strategies that succeed.

MODULE IV   DEPLOY AND MEASURE   09

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 V   CASE STUDY   08

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

Theory : 45

REFERENCES :

1. Sandra Zoratti, Lee Gallagher, "Precision Marketing: Maximizing Revenue through Relevance", 1st Edition, Kogan Page Publishers, ISBN: 978-0-7494-6535-3, 2012.
2. Jeff Zabin and Gresh Brebach, "Precision Marketing: The New Rules for Attracting, Retaining, and Leveraging Profitable", 1st Edition, John Wiley Publications, ISBN: 978-0-471-46761-8, 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
- Illustrate the various sources of data and apply in real time applications
- Analyze a given situation and develop a suitable customer strategy
- Describe the real-world account of becoming a social business through the use of data to drive customer engagement
- Design and implement different marketing strategies
- Achieve today's successful business and marketing strategies

CSCY264   COMPLEX EVENT PROCESSES   **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 students to analyze 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.
- To study about designing agents for different domains.
- To learn to measure   the performance of agents based on problems.
- To design effective patterns based on the time and cost axioms.

MODULE I   INTRODUCTION   09

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

MODULE II   COMPLEX EVENT PROCESSING   09

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

MODULE III   EVENTS TIME AND CAUSALITY   09

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   09

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

MODULE V   COMPLEX EVENTS AND UNCERTAINTIES   09

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

Theory : 45

REFERENCES :

1. David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems", Addison Wesley, ISBN:0321951832, 2013

2. Richard Seroter, Ewan Fairweather, Stephen W. Thomas, Mike Sexton and Rama, "Applied Architecture Patterns on the Microsoft Platform", Ramani Packt Publishing, ISBN:1849680558, 2010.

OUTCOMES :

Students who complete this course will be able to

- Analyze the challenges faced by today's information systems.
- Design effective patterns based on the problem defined.
- Evaluate CEP's role within a complex and evolving contemporary context.
- Evaluate the performance of agents based on problems.
- Effectively utilize events for enhanced operation based on performance and security.
- Design new agents for identified problems.

CSCY265	**DATA VISUALIZATION**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

OBJECTIVES :

- To provide insight about the importance of data visualization.
- To expose the design options in data visualization.
- To analyze the charts and plots used for suitable data type.
- To construct and evaluate visualization on real time data
- To showcase the applications of data visualization
- To provide insight about the importance of data visualization.

MODULE I   INTRODUCTION   09

The context of data visualization-Visualization as a discovery tool-The bedrock of visualization knowledge-Defining data visualization-Visualization skills-Data Visualization methodology-Visualization design objectives-Setting the purpose and identifying the key factors-Visualization's function- Visualization's tone-Key factors of visualization project-Eight hats of Data visualization design.

MODULE II   DATA AND VISUALIZATION DESIGN OPTIONS   09

Importance of editorial focus-Preparing and familiarizing the data-Refining the editorial focus-Use of visual analysis-example-conceiving and reasoning visual design options-Visualization anatomy-data representation-visualization anatomy-creating interactivity-annotation-arrangement.

MODULE III   TAXONOMY OF DATA VISUALIZATION METHODS   09

Data visualization methods-choosing the appropriate chart type-charts comparing categories-charts Accessing hierarchies and part-to-whole relationships-charts showing changes over time-charts for plotting connections and relationships-plots for showing Geo-Spatial data.

**MODULE IV   CONSTRUCTION AND EVALUATION OF DESIGN
                        SOLUTION   09**

Constructing visualizations-technology-visualization software, Applications and -programs-charting-statistical and analysis tools-programming environments-tools for mapping-The construction process-approaching the finishing line-post Launch evaluation.

MODULE V   APPLICATIONS OF DATA VISUALIZATION   09

Applications of visualization-visual analysis of social data: economic and social conditions of countries, qualitative comparison of schools-multi-dimensional data in Medicine and Pharmacology: Ophthalmological data analysis, Analysis of heart rate, Ophthalmological Binding Affinity-Correlation based visualization.

L-30; P-30

REFERENCES :

1. Andy Kirk, "Data Visualization: A Successful Design Process", Packt publishing, ISBN 978-1-84969-346-2, 2012.
2. Gintautas Dzemyda, Olga Kurasova, Julius Žilinskas," Multidimensional Data Visualization: Methods and Applications", springer, ISBN 13: 9781441902351, 2013.
3. Stephanie D. H. Evergreen , "Effective Data Visualization: The Right Chart for the Right Data", SAGE publications, ISBN-13: 978-1506303055, 2016.

OUTCOMES :

Students who complete this course will be able to

- Recognize the basics of data visualization
- Analyze visualization design options and select appropriate one for implementation
- Apply visualization techniques for various data analysis tasks
- Develop visualization and evaluate the design solution
- Apply these techniques to mine real-life situations
- Describe the different visualization models

CSCY266 PATTERN RECOGNITION

L T P C
3 0 0 3

OBJECTIVES :

- To enable the students to understand the fundamentals of Pattern recognition.
- To introduce to various Pattern recognition algorithms.
- To create the ability to choose an appropriate feature of Pattern classification algorithm for a pattern recognition problem
- To expose to the concepts and applications of classification/clustering
- To introduce the working of popular algorithms and methodologies in pattern recognition
- To explore applicability in varied domains

MODULE I PATTERN RECOGNITION OVERVIEW 09

What Is Pattern Recognition – Data Sets – Different Paradigms – Data Structures for Pattern Recognition - Representation of Clusters – Proximity Measures – Size of Patterns –Feature Extraction – Feature Selection – Evaluation of Clustering – Evaluation of Classifiers.

MODULE II CLASSIFIERS 09

Nearest Neighbor Algorithm – Variants of NN Algorithm – Data Reduction – Prototype Selection- Bayes Theorem - Minimum Error Rate Classifier – Estimation of Probabilities – Comparison with the NNC – Naïve Bayes Classifier – Bayesian Belief Network

MODULE III DECISION TREES 09

Introduction – Decision Trees For Pattern Reorganization – Construction of Decision Trees – Splitting At the Nodes – Overfitting and Pruning – Examples of Decision Tree Induction.

MODULE IV SUPPORT VECTOR MACHINES 09

Introduction to SVM - Learning the Linear Discriminant Function – Neural Networks –SVM for Classification – Methods for Combining Classifiers – Constructing Ensembles of Classifiers.

MODULE V CLUSTERING 09

Importance of Clustering – Hierarchical Algorithms – Divisive Clustering – Agglomerative Clustering– Partitional Clustering – k means – Soft partitioning -

Clustering Large Data Sets – Incremental clustering – Divide and Conquer Approach.

Theory : 45

REFERENCES :

1. M. Narasimha Murty, V. Susheela Devi, "Pattern Recognition: An Algorithmic Approach", Springer, ISBN: 978-0857294944, 2011.
2. Sergios Theodoridis, Aggelos Pikrakis, Konstantinos Koutroumbas, Dionisis Cavouras, "Introduction to Pattern Recognition: A Matlab Approach", Academic Press, ISBN: 978-0123744869, 2010.
3. Sergios Theodoridis, Pattern Recognition, Fourth Edition, Academic Press, ISBN: 978-1597492720, 2008.

OUTCOMES :

Students who complete this course will be able to

- Exhibit awareness of fundamental Pattern recognition concepts.
- Acquire skills on evaluating various factors influencing pattern recognition
- Identify the nature and inherent difficulties of pattern recognition problems.
- Comparatively analyze varied methodologies for deployment
- Select a suitable classification/clustering process, features and proper algorithm to address a desired pattern recognition problem.
- Apply pattern recognition techniques in solving problems in different domains.

SINGLE CREDIT ELECTIVE COURSES

CSCY071   WIRELESS NETWORK PROGRAMMING   **L   T   P   C**
                                                          0.5   0   1   1

OBJECTIVES :

- To gain knowledge on the programming structure
- To learn the graph concepts
- To have an exposure on the implementation of sensor networks
- To address the programming models
- To gather knowledge on the link layer protocols
- To acquire information on the issues related to flooding

TOPICS

Data structures for sensor computing – general structure of programming – Importance of graph concepts in sensor programming-Programming challenges in sensor networks - structural characteristics and properties – sensor network stack – Synchronization-Programming with link layer protocols   - ARQ protocol – transmitter role – naming and addressing – algorithms – flooding – tracking.

L – 8; P – 15

REFERENCES :

1. S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, "Fundamentals of sensor network programming: applications and technology", John Wiley & sons, ISBN 9780470890158, 2011.

OUTCOMES :

Students who complete this course will be able to

- Know the programming fundamentals of sensor computing
- Get familiarized with sensor network characteristics and stack
- Identify the programming models of sensor networks and issues related to it
- Implement the algorithms related to sensor concepts
- Know the issues related to flooding
- Explore the importance of graph concepts in network programming

CSCY072   CLOUD COMPUTING PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :
- To explore the basic cloud architecture.
- To analyze the application need and design an infrastructure.
- To extend the cloud capacity understanding the different loop holes.
- To learn the implementation of cloud services
- To comprehend the Google web services
- To get expose to cloud security

TOPICS

Design a cloud environment in stimulator-resource management-energy management in stimulated environment-Abstraction and virtualization-capacity planning-Google web service-Amazon web service-Microsoft cloud service-Manage cloud-cloud security. Moving applications to cloud-cloud-based storage.

L – 8; P – 15

REFERENCES :
1. Barrie Sosinsky" Cloud Computing Bible", Wiley India Pvt. Limited, ISBN: 978-0-470-90356-8, 2011.
2. Mark Chu-Carroll "Code in the Cloud: Programming Google App Engine" Pragmatic Bookshelf, ISBN: 1934356638,2011.

OUTCOMES :

Students who complete this course will be able to
- Design a cloud infrastructure based on different platforms.
- Compare the different cloud services provided by different cloud provider.
- Constitute the basic necessities when building an infrastructure for dynamic applications
- Illustrate the importance of energy management in stimulated environment
- Develop real time applications using cloud services
- Explore the issues in cloud security

CSCY073   BIG DATA PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To illustrate the fundamentals of programming in classes functions and invoking methods.
- To learn how to create a package and interfaces using programming tools.
- To solve the problem using Big Data programming tools.
- To gain the knowledge of designing Big data environment
- To explore the concepts of Map reduce.
- To learn the configuration of other tools supported for Big data

TOPICS

Meet hadoop – MapReduce – Hadoop File System-Configuration API – Configuring the Development Environment – Writing a unit test – Running on a cluster – tuning a job – Mapreduce work flows – how MapReduce Works

L – 8; P – 15

REFERENCES :

1. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, ISBN: 978-1-449-31152-0, 2012.

OUTCOMES :

Students who complete this course will be able to

- Design and analyze the real time problems using Hadoop.
- Create an environment to interact with users
- Configure the big data infrastructure.
- Demonstrate the concepts with processing tools.
- Develop a simple program for solving the problems using big data tools
- Apply Big data concepts into real world applications.

CSCY074   VISUAL SYSTEMS PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To introduce the concepts of visual programming.
- To explore the Visual Basic's Integrated Development Environment (IDE)
- To enable the students to develop programs and simple application using Visual C++
- To learn the basics of .NET Framework
- To become familiar with Windows Programming
- To get expose to Structured Query Language

TOPICS

Programming with Visual C++ 2008: The .NET Framework – Writing C++ Applications – Learning Windows Programming - Using the IDE-Windows Programming Basics –Using Windows Forms-The Document/View Concept in MFC – Creating MFC Applications. Working with Menus and Toolbars– Elements of a Menu –Drawing in a Window:– The Drawing Mechanism in Visual C++- Database Management with Microsoft ODBC – Structured Query Language – MFC ODBC classes – sample database applications – filter and sort strings – DAO concepts – displaying database records in scrolling view – Threading – VC++ Networking issues – Winsock – building a web client – Internet Information Server – ISAPI server extension.

L – 8; P – 15

REFERENCES :

1. Julian Templeman, "Microsoft Visual C++/CLI Step by Step", 1st Edition, Microsoft Press, ISBN: 978-0735675179, 2013.
2. Ivor Horton, "Beginning Visual C++", 1st Edition, Wroz, ISBN:978-0470500880, 2010.

OUTCOMES :

Students who complete this course will be able to

- Apply visual programming to software development by designing projects with menus and submenus
- Implement SDI and MDI applications using forms, dialogs, and other types of GUI components.

- Design and deploy applications using visual C++ programming
- Develop real time applications using Windows Programming
- Comprehend the issues relating to VC++ Networking
- Develop applications in the .NET Framework

CSCY075   OPEN SOURCE TOOLS

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To introduce to Open Source Ecosystem
- To create awareness on IPR issues, Licensing considerations
- To discuss concepts of Open Web and its role in Open Source Development
- To introduce varied opens source tool for productivity and development
- To become familiar with data analytics
- To study about the significance of FOSS tools for personal use.

TOPICS

Open Source Eco-system-IPR and Open Source-Licensing: GNU GPL, LGPL, BSD, CPL, Creative Commons-Open Web-GitHub-FOSS Tools for Personal (Individual Use)-FOSS Tools for Small Teams (Limited Users)-FOSS Tools for Corporate Usage-Open Source Productivity and Development Tools in Vogue-Domain Specific Open Source Tools (Networking, Data Analytics, Software Engineering, Database Management etc)

L – 8; P – 15

REFERENCES :

1. Sandeep Koranne, "Handbook of Open Source Tools", 1st Edition, Springer, 2011.

OUTCOMES :

Students who complete this course will be able to,

- Appreciate the significance of Open Source tools
- Comprehend the process, issues and considerations related to IPR, Licensing etc.
- Work with Open Web concepts, Github Environments etc
- Use varied Open Source tools for different productivity and development tasks
- Analyze domain specific Open Source tools
- Develop applications using FOSS tools

GENERAL ELECTIVES

GECY101   PROJECT MANAGEMENT   L   T   P   C
                                                         3   0   0   3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I   INTRODUCTION & PROJECT INITIATION   09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II   RISK ANALYSIS   09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III   PROJECT PLANNING & IMPLEMENTATION   09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV   TECHNICAL ANALYSIS   09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V   PROJECT MANAGEMENT TECHNIQUES   09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102   SOCIETY, TECHNOLGY & SUSTAINABILITY   L T P C

3 0 0 3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To 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   09

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   09

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   09

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   09**

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   09

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.

GECY103   ARTIFICIAL INTELLIGENCE   **L   T   P   C**
                                               3   0   0   3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I   HISTORY AND FOUNDATIONS   08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II   SEARCH   10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III   KNOWLEDGE REPRESENTATION AND REASONING   10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV   REPRESENTING AND REASONING WITH
                UNCERTAIN KNOWLEDGE   08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V   CASE STUDY AND FUTURE APPLICATIONS   09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I   INTRODUCTION   08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center "Green" Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II   CONSUMPTION ISSUES   10

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

MODULE III   NEXT-GENERATION VIRTUAL DATA CENTERS   09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV   TECHNOLOGIES FOR ENABLING GREEN AND
            VIRTUAL DATA CENTERS   08

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

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

MODULE V   SERVERS AND FUTURE TRENDS OF
**   GREEN COMPUTING   10**

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.

2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.

3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.

4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012

5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.

6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.

- Select appropriate technologies that are aimed to reduce energy consumption.

- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105   GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I   INTRODUCTION   09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II   THE DESIGNER CREATES AN EXPERIENCE   09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice - Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III   THE EXPERIENCE IN THE PLAYER MIND AND
GAME MECHANICS   08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV   GAMES THROUGH AN INTERFACE   09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V   BALANCED GAME MECHANICS   10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, "Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106   SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I   BASIC CONCEPTS   09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II   SOCIAL LINK   09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III   SOCIAL MEDIA   08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV   SOCIAL INFORMATION FILTERING   09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V   SOCIAL NETWORK STRATEGY   10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, "The New Social Learning, Connect. Collaborate. Work", 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, "Social Network Analysis for Ego-Nets", SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, "Social Network Analysis: History, Theory and Methodology", 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, "Social Network Analysis", Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, "Analyzing the Social Web", Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, "Social computing and Behavioral Modeling", Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107   SOFT COMPUTING

<div align="right">

L   T   P   C

3   0   0   3

</div>

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I   SOFT COMPUTING - BASICS   06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II   ARTIFICIAL NEURAL NETWORK   12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III   FUZZY SYSTEMS   09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV   NEURO FUZZY SYSTEMS   09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V   EVOLUTIONARY COMPUTING   09

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, "Real life applications of Soft Computing", CRC press, 2010.
3. Fakhreddine O. Karray, "Soft Computing and Intelligent Systems Design: Theory, Tools and Applications", Pearson, 2009

OUTCOMES:

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

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108   EMBEDDED SYSTEM PROGRAMMING   L   T   P   C

                                                 3   0   0   3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I   INTRODUCTION OF EMBEDDED SYSTEM   09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II   SOFTWARE TECHNOLOGY   09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III   INPUT/OUTPUT PROGRAMMING   09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV   DATA REPRESENTATION IN EMBEDDED SYSTEMS   09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V   EMBEDDED C   09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:
1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:
On completion of this course the student will be able to
- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109   PRINCIPLES OF SUSTAINABLE DEVELOPMENT   L   T   P   C
3   0   0   3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I   CONCEPT OF SUSTAINABLE DEVELOPMENT   09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II   COMPONENTS AND DIMENSIONS OF SUSTAINABLE
**   DEVELOPMENT   09**

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III   FRAMEWORK FOR ACHIEVING SUSTAINABILITY   09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV   SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC
**   SYSTEMS   09**

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V   SUSTAINABLE DEVELOPMENT AND INTERNATIONAL
RESPONSE   09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I   OPERATIONS RESEARCH   09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II   PRODUCTION MANAGEMENT   09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III   FINANCIAL MANAGEMENT   09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV   DECISION THEORY   09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V   MANAGERIAL ECONOMICS   09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

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

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111   PROGRAMMING USING MATLAB & SIMULINK   L   T   P   C

1   0   2   2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I   INTRODUCTION TO MATLAB AND DATA PRESENTATION   10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II   ROOT FINDING AND MATLAB PLOT FUNCTION   10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III   LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
   a. Trapezoidal Rule

      b. Euler method
2. Solution of fourth order non-linear differential equations using
      a. Modified Euler method
      b. Runge – Kutta method

MODULE IV   INTRODUCTION OF SIMULINK   12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, "Numerical Methods for Engineers", Blackwell, 1991.
2. Laurene Fausett, "Applied Numerical Analysis Using MATLAB", Pearson 2008.
3. Moin P, "Fundamentals of Engineering Numerical Analysis", Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB", CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, "Mathematical Exploration with MATLAB", Cambridge University Press, 1999.

OUTCOMES:

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

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112	JAVA PROGRAMMING	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I   INTRODUCTION TO JAVA PROGRAMMING   08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II   METHODS AND CLASSES   07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, "Java The Complete Reference", 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **"**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)", John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, "Programming with Java", 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, "**Let Us Java", 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113   PYTHON PROGRAMMING   L   T   P   C
                                                   1   0   2   2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I   INTRODUCTION TO PYTHON PROGRAMMING   08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II   EMBEDDED PROGRAMMING USING PYTHON   07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, "Python Programming", 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, "Python Programming for Arduino", 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, "Embedded C Programming and the Atmel AVR", 2nd edition, 2006.
5. Michael Barr, Anthony Massa, "Programming Embedded Systems", 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114   INTELLECTUAL PROPERTY RIGHTS (IPR)   **L   T   P   C**
                                                        1   0   0   1

OBJECTIVES:
- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I   INTRODUCTION   07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II   PATENT   08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES
1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015

8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database