

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)



M. Tech.

SOFTWARE ENGINEERING



B.S. Abdur Rahman
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech. SOFTWARE ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016



VISION AND MISSION OF THE INSTITUTION

VISION

B. S. Abdur Rahman Crescent 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 Institution
- ☐ 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

M.Tech. (Software Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES:

- PEO-1:** To impart advanced concepts of software engineering design and development.
- PEO-2:** To train the graduates in process methodologies and techniques for software development.
- PEO-3:** To provide in depth knowledge on the application of software engineering CASE tools and their relevance to industry practices.
- PEO-4:** To pursue research in software modeling and design for solving complex problems.

PROGRAMME OUTCOMES:

On completion of the programme the graduates will

- PO1:** have the knowledge and skills in the processes and practices adopted in software development.
- PO2:** be able to apply software engineering tools for solving real life problems.
- PO3:** be able to undertake need based research focus on issues related to industries.
- PO4:** be equipped with necessary skills for technical documentation and presentation.

REGULATIONS – 2016 FOR M. Tech. / MCA / M.Sc. DEGREE PROGRAMMES

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. **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai, 600048.
- iv. **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science and Technology, who administers the academic matters.
- v. **"Dean (P.G. Studies)"** means Dean (P.G. Studies) of B.S. Abdur Rahman Crescent Institute of Science and Technology, who administers all P.G Programmes of the Institution in coordination with Dean (Academic Affairs)
- vi. **"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science and Technology, who looks after the welfare and discipline of the students.
- vii. **"Controller of Examinations"** means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science and Technology, who is responsible for conduct of examinations and declaration of results.

PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

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

Modes of Study**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.

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.

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.

Admission Requirements

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 Institution 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 Institution as equivalent thereto.

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.

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

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)

DURATION AND STRUCTURE OF THE P.G. PROGRAMME

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

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

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

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.

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

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

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)

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

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.

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

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.

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.

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

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.

Project Work / Thesis / Dissertation

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

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.

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. 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.

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.

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.

CLASS ADVISOR AND FACULTY ADVISOR

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.

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.

CLASS COMMITTEE

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.

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

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.

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).

REGISTRATION AND ENROLMENT

For the first semester every student has to register for the courses within one week from the commencement of the semester

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.

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

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.

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

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.

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

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

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)

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).

MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

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

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.

DISCIPLINE

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.

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.

ATTENDANCE

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

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 Institution 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.

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.

SUMMER TERM COURSES

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.

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.

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.

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

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

ASSESSMENTS AND EXAMINATIONS

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.

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

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.

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.

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.

WEIGHTAGES

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%

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.

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.

SUBSTITUTE EXAMINATION

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.

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.

COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

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

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.

A course successfully completed cannot be repeated for any reason.

AWARD OF LETTER GRADE

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.

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).

DECLARATION OF RESULTS

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.

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.

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.

COURSE REPETITION AND ARREARS EXAMINATION

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.

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.

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.

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.

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.

GRADE SHEET

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.

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 i^{th} course

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

‘I’ and ‘W’ grades will be excluded for GPA calculations.

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

Classification of the award of degree will be as follows:

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.

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.

ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

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

- successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,
- no disciplinary action is pending against him/her.

The award of the degree must be approved by the Institution.

22.0 POWER TO MODIFY

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

CURRICULUM & SYLLABI FOR M. Tech. (Software Engineering) Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
SEMESTER I						
1	MAC6183	Probability and Statistics	3	1	0	4
2	CSC6121	Software Requirement Analysis and Estimation	3	0	0	3
3	CSC6122	Software Quality Assurance	3	0	0	3
4	CSC6123	Software Design and Architecture	3	0	2	4
5	CSC6124	Software Testing	3	0	2	4
6	CSC6125	Agile Process Methodology	3	0	2	4
7	CSC6126	Case Study	0	0	2	1
						23
SEMESTER II						
1	ECC6203	Research Methodology for Electronics Engineers	3	1	0	4
2	CSC6221	Integrated Software Project Management	3	0	0	3
3	CSC6222	Formal Methods for Software Engineering	3	0	0	3
4		Professional Electives [#]				9
						19
SEMESTER III						
1	CSC7121	Internship* / Term paper	0	0	2	1
2		Professional Electives ^{##}				9
3		General Elective	3	0	0	3
4	CSC7122	Project – Phase I	0	0	12	6
						13

Sl. No.	Course Code	Course Title	L	T	P	C
SEMESTER IV						
1	CSC7122	Project – Phase II	0	0	36	18
					6+18=24	
Total						79

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

* - Internship must be taken after the completion of II semester examinations.

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

PROFESSIONAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
LIST OF ODD SEMESTER ELECTIVES						
1	CSCY121	Software Agents	2	0	2	3
2	CSCY122	Personal Software Process	3	0	0	3
3	CSCY123	Software Maintenance	3	0	0	3
4	CSCY124	Green Software Engineering	3	0	0	3
5	CSCY125	Risk Analysis and Management	3	0	0	3
6	CSCY126	High Performance Computing	3	0	0	3
7	CSCY127	Principles of Grid Computing	1	0	2	2
8	ECC6121	Advanced Embedded Systems	3	0	0	3
LIST OF EVEN SEMESTER ELECTIVES						
1	CSCY210	Pervasive Computing	3	0	0	3
2	CSCY213	Multimedia Systems	1	0	2	2
3	CSCY221	Distributed Systems	3	0	0	3
4	CSCY222	IT Systems Management	3	0	0	3
5	CSCY223	Team Software Process	3	0	0	3
6	CSCY224	User Interface Design	1	0	2	2
7	CSCY225	Multimodal Computing	3	0	0	3
8	CSCY226	Online Course Management System	1	0	2	2
9	ITC6201	Cloud Computing Technologies	3	0	0	3
LIST OF SINGLE CREDIT ELECTIVE COURSES						
1	CSCY071	Wireless Network Programming	0.5	0	1	1
2	CSCY072	Cloud Computing Programming	0.5	0	1	1
3	CSCY073	Big Data Programming	0.5	0	1	1

Sl. No.	Course Code	Course Title	L	T	P	C
4	CSCY074	Visual Systems Programming	0.5	0	1	1
5	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

MAC6183 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVES :

- a comprehensive introduction to the probability distributions.
- familiarize with testing of hypothesis and estimation theory.
- basic knowledge in simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10 + 03

Axioms of probability – addition and multiplication theorem – conditional probability – total Probability – random variables- moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 09 + 03

Joint distributions - Marginal and conditional distributions – functions of random variables - Covariance - Correlation and regression - Central limit theorem.

MODULE III ESTIMATION THEORY 09 + 03

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

MODULE IV TESTING OF HYPOTHESIS 08 + 03

Hypothesis, test statistic, decisions and errors - classical testing, significance and p-values – Student's t- test , Fisher's test and Chi-square tests

MODULE V SIMULATION 09 + 03

Simulation - definition - Monte Carlo simulation - random number generation, simulation model building - validation - run size determination - simulation applications - inventory control - facilities creation, simulation software.

L – 45; T – 15

TEXT BOOKS :

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.

2. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, PHI, 2011.
3. Sheldon M. Ross, "Introduction to probability models", 10th edition, Academic Press, 2009.

REFERENCES :

1. Jerry Banks, John S. Carson, Barry L. Nelson, "Discrete – Event systems Simulation", Prentice Hall India, New Delhi, 1999.
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Duxbury publication, 2007.
3. R. Lyman Ott, Michael Longnecker, "An Introduction to Statistical Methods and Data Analysis", 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

OUTCOMES :

Students who complete this course will be able to

- identify and fit probability distribution for a given data.
- solve two dimensional random variable problem.
- solve estimation theory problem.
- testing the hypothesis.
- solve problems in modeling using simulation techniques.

CSC6121	SOFTWARE REQUIREMENT ANALYSIS AND ESTIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To enable the students to identify the role of requirement engineering in software engineering.
- To make the students to be aware of the fundamentals of software requirements
- To focus on the Software Lifecycle.
- To introduce documentation of software requirements
- To acquire knowledge on the various Requirements management tools.
- To give awareness about Software Estimation Tools.

MODULE I THE CONTEXT OF SOFTWARE REQUIREMENTS 08

The essential of software requirement – Software Estimation – Software Lifecycle – Software Projects – Management Activities in a Software Project – Good practices for requirements engineering – Software Engineering.

MODULE II SOFTWARE REQUIREMENTS SPECIFICATION 08

Requirements Elicitation – Requirements Analysis – Requirements Validation – Requirements Management-Documenting the requirements- software requirements specification-Guidelines for Writing excellent requirements-Modeling real-time systems projects-Specifying reports.

MODULE III SOFTWARE REQUIREMENT DEVELOPMENT 10

Establishing the product vision and project scope – Finding the voice of customer hearing the voice of customer – Understanding user requirements–Validating the requirements-Software Process model- Requirements development tools, Requirements management tools- Selecting and implementing a requirements tool

MODULE IV SOFTWARE REQUIREMENT AND FUNCTIONAL ANALYSIS 09

Size Estimation - Function Point Analysis- Mark II FPA-Full Function Points – Other Function Point Extensions – Approximate Function Point Computations – Directions in Functional Size Measurements - LOC Estimation

MODULE V SOFTWARE ESTIMATION AND TOOLS 10

Estimation Factors - Approaches to Effort and Schedule Estimation - COCOMO II - Putnam Estimation Model – Using Complexity As Estimator – Estimation By

Analogy - Algorithmic Models –Bottom Up Estimation - Cost Estimation – Validating Software Estimates. Desirable features in software estimation tools- IFPUG- USC's COCOMO II - SLIM (Software Life Cycle Management) Tools.

Theory: 45

REFERENCES :

1. Karl E Wieggers , Joy Beatty ,” Software Requirements”, 3rd Edition, Microsoft, ISBN: 978-0-7356-7966-5, 2012.
2. Ian Sommerville,”Software Engineering”, 10th Edition, Pearson Education India, ISBN: 978-0-1339-4303-0, 2015.

OUTCOMES :

Students who complete this course will be able to

- Explain the role of software requirements development.
- Explore the requirements process and its relationships to the rest of the software development life cycle.
- Write software requirement specification (SRS) for any real time case study
- Develop different design solutions to a given problem and recommend the best one within limitations of cost, time, knowledge, existing systems and organizations.
- Illustrate the importance of software requirements analysis during the stages of software development
- Analyze the types of Estimation Model and apply them to various real time applications

CSC6122 SOFTWARE QUALITY ASSURANCE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To recognize fundamental concepts of quality assurance, SQA activities and SQA metrics.
- To get an insight into the various quality control tools.
- To explore the guidelines prescribed by the various quality standards like CMMI.
- To investigate the techniques and tools for Software testing.
- To minimize the produced defects, increase the product quality.
- To effectively log and manage identified defects.

MODULE I QUALITY CONCEPT**08**

Quality Perspectives –Quality Models – Cost of Quality – Current Challenges and Future Directions of Software Quality- Addressing System Qualities- Accessing Qualities – Requirement Conformance Versus Customer Satisfaction- Non Functional Requirements.

MODULE II SOFTWARE QUALITY CHARACTERISTICS**09**

Software Quality Management – Software Quality Models- Process based Approaches to Software Quality – Quality Factor Perspectives – Organization's Software Quality Characterization Model – Software Quality Control's Utilization- SPI Utilization .

MODULE III SOFTWARE QUALITY CHALLENGES**09**

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

MODULE IV SOFTWARE QUALITY REFINEMENT**09**

Process Improvement: Process Classification, Process Measurement, Software Process - Definition and implementation; internal Auditing and Assessments; Software testing -Concepts, Tools, Reviews, Inspections & Walk through; P-CMM – Software/System Development Lifecycle - Configuration Management Planning and Process.

MODULE V QUANTIFIABLE QUALITY IMPROVEMENT**10**

QA monitoring and measurement, Analysis and follow up actions, Implementations, Integration and tool support, Models for Quality Assessment, Generalized and product specific models. Risk Identification for quantifiable quality improvement: Traditional statistical analysis techniques, new techniques for risk identification. Software Reliability Engineering.

Theory: 45**REFERENCES :**

1. Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy, Bedir Tekinerdogan "Software Quality Assurance: in Large Scale and Complex Software intensive", 1st Edition, Elsevier Publication, ISBN :9780128023013,2016.
2. Abu Sayed Mahfuz" Software Quality Assurance: Integrating Testing, Security, and Audit" ,Auerbach Publications , ISBN 9781498735537, 2016.
3. Milind Limaye, " Software Quality Assurance", Tata Mcgraw Hill Education Private Limited,ISBN-13: 9780071072526,2011.
4. Chemuturi, Murali, "Best Practices, Tools and Techniques for Software Developers Data", Ross Publishing, 2010.
5. Gordon G Schulmeyer, "Handbook Of Software Quality Assurance", 3rd Edition, Artech House Publishers, 2009.

OUTCOMES :

Students who complete this course will be able to

- Effectively apply software quality control tools.
- Identify the software quality attributes and explore the quality standards.
- Apply software testing techniques and identify the inputs and deliverables of testing.
- Evaluate how new technologies impact software quality assurance and the system's development life cycle.
- Gain the techniques and skills on how to use modern software testing tools to support software testing projects.
- Critically evaluate different software development environments and contexts with respect to the application of appropriate standards and models.

CSC6123	SOFTWARE DESIGN AND ARCHITECTURE	L	T	P	C
		3	0	2	4

OBJECTIVES :

- To gain knowledge on the challenges of advanced software design.
- To introduce various software design techniques.
- To acquire knowledge on the various Architectural styles and patterns.
- To learn the various issues relating to software design.
- Illustrate the various Architectural styles and their applications.
- To have an over view of the fundamentals of Quality Attributes.

MODULE I INTRODUCTION 08

Software Architecture- Architectural Structures and Views- Architectural Patterns- Good architecture – Importance of Software Architecture - Many Contexts of Software Architecture

MODULE II ARCHITECTURAL STYLES 10

Architectural styles - Pipes and filters - Data abstraction and object-oriented organization - Event-based, implicit invocation - Layered systems – Repositories – Interpreters - Process control - Other familiar architectures - Heterogeneous architectures.

MODULE III QUALITY ATTRIBUTES 09

Understanding Quality Attributes- Availability –interoperability- Modifiability - Performance - Security - Testability - Usability - Other Quality Attributes- Architectural Tactics and Patterns- Architectural patterns and styles

MODULE IV ARCHITECTURE IN THE LIFECYCLE 09

Architecture in Agile Projects- Designing an Architecture- Documenting Software Architectures- Architecture, Implementation, and Testing- Architecture Evaluation- Economic Analysis of Architectures

MODULE V DESIGN PATTERNS 09

Introduction from mud to structure: Layers. Distributed Systems: Broker - Interactive Systems: MVC- Structural decomposition: Whole – Part; Organization of work: Master – Slave

L – 45; P 30

REFERENCES :

1. Paul Clements, Rick Kazman, "Software Architecture in Practice – Len Bass", 3rd Edition, Pearson Education, ISBN: 978-0-321-81573-6, 2013.
2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern-Oriented Software Architecture, A System of Patterns", 2nd Edition, Volume 1, John Wiley and Sons, ISBN: 0- 471-95889-7, 2008.
3. Mary Shaw and David Garlan,"Software Architecture- Perspectives on an Emerging Discipline", Prentice-Hall of India, ISBN:0-13-182957-2, 2007.

OUTCOMES :

Students who complete this course will be able to

- Define the terminology, features, and characteristics embodied in Architectural styles.
- Apply the principles behind software patterns to design real time applications.
- Comprehend the quality attributes of the software architecture chosen
- Acquire practical competence in the usage and application of tools to support automated software analysis.
- Adopt different architectural styles for designing a system.
- Compare the functioning of various Architectural patterns.

CSC6124 SOFTWARE TESTING

L	T	P	C
3	0	2	4

OBJECTIVES :

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.
- To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
- To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects.
- To appreciate software test automation problems and solutions.
- To train how to write software testing documents, and communicate with engineers in various forms.

MODULE I INTRODUCTION**09**

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

MODULE II TEST ORGANIZATION**09**

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

MODULE III TEST CASE DESIGN TECHNIQUES**09**

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

MODULE IV MODULE TESTING – HIGHER ORDER TESTING**09**

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

MODULE V DEBUGGING**09**

Debugging by Brute Force – Debugging by Induction – Debugging Deduction– Debugging by Backtracking – Debugging by Testing – Debugging Principles – Error Analysis. Testing in Agile environment. Testing challenges and strategies.

L – 45; P 30**REFERENCES :**

1. Srinivasan Desikan and Gopalswamy Ramesh, “ Software Testing : Principles and Practice”, Pearson ,ISBN-13: 978-8177581218, 2014.
2. Naresh Chauhan, “ Software Testing”, OUP India, ISBN-13: 978-0198061847, 2010.
3. Glenford J. Myers, Corey Sandler, “The Art of Software Testing”, 3rd Edition, Wiley, ISBN 978-1-118-03196-4, 2011.
4. Ali Mili, FairouzTchier , “Software Testing: Concepts and Operations”, Wiley, ISBN: 978-1-118-66287-8, 2015.
5. Ron Patton, “Software Testing”, 2nd Edition, Sams Publishing, ISBN-10: 0672327988 , 2006.

OUTCOMES :

Students who complete this course will be able to

- Apply software testing knowledge and engineering methods.
- Design and conduct a software test process for a software testing project.
- Identify the needs of software test automation, and define and develop a test tool to support test automation.
- Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
- Use various communication methods and skills to communicate with their teammates to conduct their practice-oriented software testing projects.
- Employ software testing methods and modern software testing tools for their testing projects.

CSC6125 AGILE PROCESS METHODOLOGY

L	T	P	C
3	0	2	4

OBJECTIVES :

- To introduce the fundamentals of agile business objectives.
- To focus on the phases of agile project management.
- To equip the student on the scaling techniques for agile projects.
- To analyze the performance of agile projects.
- To develop the skills of the students on product development.
- To equip the students on agile delivery and risk mitigation.

MODULE I INTRODUCTION 09

Agile business objectives – leadership values – performance measurement – agile project management framework – value over constraints – teams over tasks

MODULE II AGILE PROJECT MANAGEMENT 09

Agile enterprise framework – delivery framework – envision phase – product vision – project objectives and constraints – project community – speculate phase – release planning – explore phase – adapt and close phase.

MODULE III SCALING AGILE PROJECTS 09

Scaling factors – scaling model – building large agile teams – Scaling up – Agile practices – Scaling out – distributed projects - Governing agile projects – Portfolio governance – Portfolio management topics.

MODULE IV MEASURING AGILE PERFORMANCE 09

Planning and measuring – measuring concepts – outcome performance metrics – output performance metrics – reliable innovation – new product development – agile people and processes deliver agile products.

MODULE V AGILE DELIVERY IN ENTERPRISE 09

Agile governance – practices – measuring agile teams – risk mitigation – feedback cycle – incremental delivery – enterprise awareness – streamlining inception – transition – adopting agile governance.

L – 45; P 30

REFERENCES :

1. Cockburn, Jim Highsmith, "Agile project management – creating Innovative products", Pearson Education , ISBN 9780321658395, 2013.
2. Scott W.Ambler , Mark Lines, "Disciplined Agile Delivery: A Practitioner's Guide to Agile Software ", IBM Press, ISBN 0132810107 , 2012.

OUTCOMES :

Students who complete this course will be able to

- Summarize the concepts of agile practices and business objectives.
- Gain knowledge on the phases of agile development framework.
- Have an exposure on the scaling factors and models to be developed for agile projects.
- Acquire knowledge on the agile performance measurement.
- Develop the product based on agile factors with risk mitigation.
- Describe the role of agile in enterprise management and incremental delivery.

SEMESTER II

ECC6203	RESEARCH METHODOLOGY FOR ELECTRONICS ENGINEERS	L	T	P	C
		3	1	0	4

OBJECTIVES :

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To be trained about research, design, information retrieval, problem formulation
- 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 and writing of research reports, papers and ethics in research.

MODULE I RESEARCH PROBLEM FORMULATION 09

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

MODULE II RESEARCH DESIGN 10

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 USE OF STATISTICAL TOOLS IN RESEARCH 12

Importance of statistics in research - Concept of probability - Popular distributions - Sample design. Hypothesis testing, ANOVA, Design of experiments - Factorial designs - Orthogonal arrays.

MODULE IV DATA COLLECTION, ANALYSIS AND INTERPRETATION OF DATA 10

Sources of Data, Use of Internet in Research, Types of Data - Research Data Processing and analysis - Interpretation of results- Correlation with scientific facts - repeatability and reproducibility of results - Accuracy and precision –limitations, Application of Computer in Research- Spreadsheet tool, Presentation tool-Basic principles of Statistical Computation.

MODULE V: OPTIMIZATION TECHNIQUES 10

Use of optimization techniques - Traditional methods – Evolutionary Optimization Techniques. Multivariate analysis Techniques, Classifications, Characteristics, Applications -correlation and regression, Curve fitting.

MODULE VI THE RESEARCH REPORT**09**

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Software for paper formatting like LaTeX/MS Office, Reference Management Software, Software for detection of Plagiarism –Thesis writing – Organization of contents – style of writing – graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Total : 60**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 :

The graduates will have the capability to:

- Formulate the research problem
- Design and Analyse the research methodology
- Apply statistical techniques for hypothesis construction
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

**CSC6221 INTEGRATED SOFTWARE PROJECT
MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To highlight the importance of software project management.
- To discuss various processes in Software Project Management.
- To provide tools and techniques for project monitoring.
- To expose different project management life cycles.
- To plan and manage projects at each stage of the software development life cycle.
- To develop the skills for tracking and controlling software deliverables

MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 09

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

MODULE II PROJECT MANAGEMENT PROCESS GROUPS 09

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

MODULE III TPM PROJECT 09

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

MODULE IV ESTABLISHING PROJECT MANAGEMENT LIFE CYCLES 09

Understanding the Complexity/Uncertainty - Traditional Project Management - Incremental Project Management Life Cycle - Agile Project Management-Iterative Project Management Life Cycle- Adaptive Project Management Life Cycle – Adapting and Integrating the APM Toolkit.

**MODULE V EFFECTIVE PROJECT MANAGEMENT & MANAGING
REALITIES OF PROJECTS****09**

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes- Prevention and Intervention Strategies for Distressed Projects- Organizing and Managing Multiple Team Projects.

Theory 45**REFERENCES :**

1. Robert K. Wysocki, "Effective Project Management – Traditional, Agile, Extreme", 6th Edition, Wiley Publication, ISBN: 1118080653, 2011.
2. Robert K. Wysocki, "Effective Software Project Management", 3rd Edition, Wiley Publication, ISBN: 9780764596360, 2010.
3. Murali Chemuturi, Thomas M. Cagley , "Mastering Software Project Management: Best Practices, Tools and Techniques", J.Ross publishing, ISBN:9781604270341, 2010.
4. S. A. Kelkar, "Software Project Management: A Concise Study", 3rd edition, PHI learning pvt Ltd ,ISBN: 9788120347021, 2013.

OUTCOMES :

Students who complete this course will be able to

- Design a project management plan using different project management life cycles.
- Establish a TPM project, monitor and control it.
- Find a suitable project management life cycle model for effective project execution.
- Analyze the risks associated with the projects.
- Evoke the project management groups and manage client expectations
- Manage real time projects and its realities.

CSC6222 FORMAL METHODS FOR SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expound on the need for formal method
- To relate formal methods to software engineering
- To showcase notations used in formal methods
- To describe tools used in formal semantics
- To enumerate the formal specification techniques
- To show how formal methods can be used in verification

MODULE I INTRODUCTION
09

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

MODULE II Z-NOTATION
09

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

MODULE III FORMAL SEMANTICS AND TOOLS
09

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

MODULE IV FORMAL METHODS FOR COMPLEX SOFTWARE SYSTEMS
09

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

MODULE V PROGRAM VERIFICATION
09

A framework for software verification – Hoare triples – Proof calculus for partial correctness – Proof calculus for total correctness.

Theory 45

REFERENCES :

1. Michael Huth and Mark Ryan, "Logic in Computer Science :Modelling and Reasoning about Systems", 2nd Edition, Cambridge University Press, ISBN: 978-0521670890, 2004.
2. Hossam A Gobbari, "Modern Formal Methods and Applications", Springer, ISBN: 978-1402042225, 2006.
3. John Vince, "Foundation Mathematics for Computer Science: A Visual Approach", Springer, ISBN: 978- 331921427, 2015.

OUTCOMES :

Students who complete this course will be able to

- Define formal methods and explain its applications
- Explain the strengths and weakness of formal methods
- Trace the structure of Z-notation and write on its application
- Describe the method by which formal methods can be used in development of tools
- Outline the role of formal methods in development of complex software
- Trace the application of formal methods in program verification.

PROFESSIONAL ELECTIVES

ODD SEMESTER ELECTIVES LIST

CSCY121 SOFTWARE AGENTS

L	T	P	C
2	0	2	3

OBJECTIVES :

- To introduce the concepts, techniques and applications of software agents.
- To expose the architecture of different agents.
- To explore the security issues.
- To give basic knowledge of agent types and interactions
- To assess the capabilities of agents.
- To make aware of various techniques to develop agents with security.

MODULE I AGENTS AND ENVIRONMENT 09

Agent - Intelligent Agent – uses of agents - Actions and Percepts - Proactive and Reactive Agents - Social Agents - Agent Execution Cycle.

MODULE II DESIGN OF AGENT 09

System Specification - Architectural Design - Detailed Design - Agent-Oriented Methodologies - Goal Specification – Functionalities – Scenario development - Interface Description

MODULE III AGENT TYPES AND INTERACTIONS 09

Grouping Functionalities - Agent Coupling - Agent Descriptors - Interaction Diagrams - Interaction Protocols - Message Descriptors.

MODULE IV DETAILED DESIGN: AGENTS, CAPABILITIES AND PROCESSES 09

Capabilities of agents - Process Specifications - Sub-tasks and Alternative Plans - Action and Percept Detailed Design – Agent Completeness and Consistency.

MODULE V AGENT SECURITY 09

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

L-30; P-30

REFERENCES :

1. Mohammad Essaaidi, Maria Ganzha, and Marcin Paprzycki, "Software Agents, Agent Systems and Their Applications", IOS Press, ISBN:9781607508175, 2012.
2. Mark d Inverno and Michael Luck, "Understanding Agent Systems", Springer, 2010.
3. Gerhard Weiss, "Multi Agent Systems - A Modern approach to Distributed Artificial Intelligence", 2nd Edition, MIT Press, ISBN-13: 978-0262731317, 2013.
4. Lin Padgham and Michael Winikoff, "Developing Intelligent Agent Systems: A Practical Guide", John Wiley & Sons Publication, 2004.

OUTCOMES :

Students who complete this course will be able to

- Identify and explore the advantages of agents.
- Design the architecture of an agent.
- Provide authentication for agents.
- Apply agent communication languages for developing simple mobile agent applications.
- Develop an agent based system for a particular task.
- Recognize the implementation of agent based system.

CSCY122 PERSONAL SOFTWARE PROCESS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To portray of software Development process
- To expose how to manage and track the time for software processes
- To provide strong foundation how to measure size of a product
- To discuss ways to measure the size, time, and defects in their work.
- To design how to schedule a process
- To implement how to estimate the product and process quality.

MODULE I INTRODUCTION AND TIME MANAGEMENT**09**

Software Engineering – Personal Software Process – Improvement Process – Personal Process Strategy – Baseline Personal Process - Software Engineers Job. Time Management – Logic of Time Management - Elements of Time Management – Categorizing your Activities – Gather Data on time spent by Activity – Tracking Time.

MODULE II PRODUCT PLANNING AND PRODUCT SIZE**09**

Product Plan - Need for product Planning – Planning Small Jobs – Job Number Log – Product Planning Process – Size Measurement - Program Size – Estimating Program Size

MODULE III ESTIMATION AND MANAGEMENT AND PLANNING**09**

Software Estimating – Probe Estimating Model –Product size - Function points. Defining Commitment – Responsibly made Commitment -Importance of Managing Commitments – Consequences of not Managing Commitments – Way to Manage Commitments – Need for Schedules –Gnatt Chart – Making a Project Schedule – Checkpoints – Tracking Project Plans– Tracking Earned Value.

MODULE IV SOFTWARE DEVELOPMENT PROCESS**09**

Need for Processes – Process Script – Checkpoints and phases – Updated Project Plan Summary Form - Defects – Software Quality – Defects and Quality –Defects Versus Bugs – Defect Types – Understanding Defects – Defect Recording Log – Steps in Finding Defects – Ways to Find and Fix Defects.

MODULE V PRODUCT AND PROCESS QUALITY**09**

Defects Versus Bugs – Defect Types – Understanding Defects – Defect Recording Log – Steps in Finding Defects – Ways to Find and Fix Defects.-- Code Review

Checklist – Projecting Defects –Economics of Defect Removal – Design Defects.
Product Quality – Testing – The Filter view of Testing - Calculating yield values –
Estimating the Ultimate Yield – Prototyping – Process Quality - Process Measures
Defects – Software Quality – Defects and Quality

Theory : 45

REFERENCES :

1. Dushyant Kumar” Introduction to the Personal Software Process”, First Edition, Pearson Education, ISBN-13: 978-8131772546, 2012.
2. Frank Tsui , Orlando Karam Essentials Of Software Engineering 3rd Edition, Jones & Bartlett Learning , ISBN-10: 1449691994 , ISBN-13: 978-14496919982013,2013.
3. Humphrey, Watts S. “Introduction to the Personal Software Process”, 2nd Edition, Pearson Education, ISBN-13: 978-8177586725, 2002.
4. Humphrey, Watts S., “PSP: A Self - Improvement Process for Software Engineers”,1st Edition, Boston, MA: Addison - Wesley, ISBN-13: 978-03213054972007,2005.
5. Roger S Pressman, “Software Engineering: A Practitioner's Approach”, 6th Edition, Tata McGrawhill, ISBN-13: 978-0071267823,2005.

OUTCOMES :

Students who complete this course will be able to

- Apply the time management skills in personal software development process.
- Analyze and improve the quality of personal software development process.
- Identify the various kinds of software defects in defect development life cycle.
- Elaborate on the PSP quality strategy to manage the defects in the work and support the team’s quality goals.
- Manage the quality of their projects.
- Reduce the number of defects in their work.

CSCY123 SOFTWARE MAINTENANCE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To describe the importance of software maintenance.
- To demonstrate the software maintenance processes and tools for maintenance.
- To explain the normal and special practices for software maintenance.
- To expose coherent and comprehensive coverage of software change concepts.
- To have a theoretical base for the skills required to effect, control and manage changes in software systems.
- To equip participants with basic knowledge and skills about computer hardware and software maintenance and troubleshooting of common problems.

MODULE I BASIC CONCEPTS**09**

Evolution Versus Maintenance – Software Evolution Models and Processes – Reengineering: Concepts ,Process, Techniques – Legacy Systems – Impact Analysis – Categories of Maintenance Concepts – Maintenance of cost-based Systems.

MODULE II MAINTENANCE MODELS**09**

Reuse-Oriented Model – Staged Model: Closed Source Model, Open Source Software – Change Mini-Cycle Model – IEEE/EIA Maintenance Process – ISO/IEC 14764 Maintenance Process - Software Configuration Management – CR Workflow.

MODULE III MIGRATION & IMPACT ANALYSIS**08**

Wrapping – Migration – migration planning – Migration Methods – Impact Analysis Process – Dependency Based Impact Analysis – Ripple Effect – Change Propagation Model.

MODULE IV REFACTORING PROCESS**09**

Activities in a Refactoring Process – Formalisms for Refactoring – Examples – Initial work on Software Restructuring- Reuse Models – Domain Engineering – Reuse Capability – Maturity Model.

MODULE V PROGRAM COMPREHENSION**10**

Cognition Models for Program Understanding – Domain Engineering – Maturity Models - Protocol Analysis – Visualization for Comprehension - Configuration and Change Management – Process - Service and Software Quality Assurance - Maintenance Measurement and Analysis - Case Studies.

Theory 45**REFERENCES :**

1. PriyadarshiTripathy ,KshirasagarNaik , “Software Maintenance and Evolution: A Practitioner's Approach” John Wiley & Sons, Hoboken, NJ , ISBN: 978-0-470-60341-3,, 2014.
2. JorgRech , Christian Bunse,” Emerging Technologies for the Evolution and Maintenance of Software Models” ISBN13: 9781613504383, 2011.
3. Donald J.Reifer, “ Software Maintenance Success Recipes”, CRC Press,2011.
4. Alain April, Alain Abrain, “Software Maintenance Management Evolution and Continuous Improvement”, IEEE computer Society Publication, 2008.
5. Penny Grubb, Armstrong A .Takang, “Software Maintenance Concepts and Practice”, 3rd Edition, World Scientific Publishing Company, 2008.

OUTCOMES :

Students who complete this course will be able to

- Formulate the maintenance procedures in routine maintenance.
- Relate process models and software maintenance tools in Software maintenance.
- Apply methods to solve software problems and analyze the case studies in Software maintenance.
- Identify and correct common faults in software applications.
- Utilize operating system components, diagnostic software and supplied documentation to detect and correct faults.
- Install and upgrade of antivirus software.

CSCY124 GREEN SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn the basic concepts of green software engineering.
- To get familiarized on the environments and processes involved in green software engineering.
- To aware of green software services model in green software processes.
- To explore the economic factors and quality factors in green in software engineering.
- To provide an idea on the measurement and maintenance of green software processes
- To study the requirements engineering and software testing in green software engineering.

MODULE I INTRODUCTION 09

Introduction to Green in Software Engineering – Sustainability- From Sustainability to Green ability- Green in Software Engineering

MODULE II GREEN ENVIRONMENTS, PROCESSES AND CONSTRUCTION 09

Green Software Engineering Environments- Processes for Green and Sustainable Software Engineering- Constructing Green Software Services: From Service Models to Cloud-Based Architecture.

MODULE III ECONOMIC AND OTHER QUALITIES 09

Economic Aspects of Green ICT- Green Software Quality Factors and Economic Factors.

MODULE IV SOFTWARE DEVELOPMENT PROCESS 09

From Requirements Engineering to Green Requirements Engineering -Towards Green Software Testing

MODULE V GREEN SOFTWARE MAINTENANCE AND QUALITY 09

Green Software Maintenance-Green Software and Software Quality-Green Software Measurement

Theory : 45

REFERENCES :

1. Calero Coral, Piattini Mario, "Green in Software Engineering", Springer International Publishing, 978-3-319-08580-7, 2015.
2. XiaodongLiu, Yang Li "Green Services Engineering, Optimization, and Modeling in the Technological Age", IGI Global, 978-1466684478, 2015.

OUTCOMES :

Students who complete this course will be able to

- Aware of the basics concepts of green software engineering.
- Explore the green software services of green Software Engineering
- Evaluate the service models available in green software engineering.
- Analyze the environments and processes involved in Sustainable Software Engineering.
- Demonstrate the green software construction using cloud based models.
- Describe the maintenance and measurement of green software services.

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.

CSCY126 HIGH PERFORMANCE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To describe the detailed insight into the modern processors
- To illustrate the basic optimization techniques for serial code
- To outline fundamental concepts of parallel computers and parallelization
- To showcase programming threads and OpenMP
- To discuss the distributed memory programming constructs in MPI
- To highlight the CUDA's programming model

**MODULE I MODERN PROCESSORS AND BASIC OPTIMIZATION
TECHNIQUES FOR SERIAL CODE**
09

Modern Processors Stored-program computer architecture – General purpose cache-based microprocessor architecture - Memory hierarchies – Multicore processors - Multithread processors - Vector processors - Basic optimization techniques for serial code - Common sense optimizations - Simple measures - large impact - Data Access Optimization - Balance analysis and lightspeed estimates-Storage order -Case study: The Jacobi algorithm and Dense matrix transpose - Algorithm classification and access optimizations.

MODULE II SHARED-MEMORY PROGRAMMING : THREADS
09

Introduction –Threads – Design concerns – semaphores – Applying semaphores in classical problems – Monitors – Applying monitors in classical problem - Dynamic Vs Static thread management –Debugging multithreaded applications – Higher-level constructs: multithreaded programming Vs threads

MODULE III SHARED MEMORY PROGRAMMING: OPENMP
09

Introduction - First openMP program – variable scope- loop level parallelism – Task parallelism – Synchronization constructs - correctness and optimization issues – A Case study : sorting in OpenMP

MODULE IV DISTRIBUTED MEMORY PROGRAMMING
09

Communicating processors – MPI – Core concept – First MPI program – Program structure – point to point communication – Non blocking communications – Error reporting and handling – collective communications – communicating objects – Node management – one side communication – Input output consideration – combining MPI with threads – Debugging and profiling MPI programs – Case Study: Diffusion limited aggregation

MODULE V GPU PROGRAMMING**09**

GPU Programming CUDA's programming Model – CUDA's execution model – CUDA compilation process – putting together a CUDA project – Memory hierarchy – optimization techniques – Dynamic parallelism – Debugging CUDA programs – profiling CUDA programs – CUDA and MPI – Case studies: fractal set calculation and Block Cipher encryption.

Theory 45**REFERENCES :**

1. Georg Hager and Gerhard Wellein, "Introduction to High performance computing Scientists and Engineers(Chapman & Hall/CRC Computational Science)", 1st edition, CRC Press, ,Taylor and Francis Group, ISBN-13: 978-1439811924, 2016.
2. Gerassimos Barlas, Morgan Kaufmann, "Multicore and GPU Programming – An integrated Approach", Imprint of Elsevier, ISBN-13: 978-0124171374, 2015.
3. John Levesque and Gene Wagenbreth Chapman & Hall "High Performance Computing: Programming and Applications", ISBN 9781420077056, 2010.
4. John L. Hennessy and David Patterson, "Computer Architecture- A Quantitative Approach", Elsevier, ISBN-13: 978-0123838728, 2012.
5. Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, Mastering Cloud Computing, Tata McGraw Hill, ISBN -13:978-1-25-902995-0, 2013.

OUTCOMES :

Students who complete this course will be able to

- Possess the basic understanding of the modern processor architecture
- Demonstrate the parallelization, parallelism and parallel scalability
- Apply semaphores and monitors classical problems
- Implement OpenMP programming to solve the sorting problems
- Review skills to communicate processors using MPI
- Develop CUDA's programming model to solve problems on a model of computation and simulate encryption systems.

CSCY127 PRINCIPLES OF GRID COMPUTING

L	T	P	C
1	0	2	2

OBJECTIVES :

- To illustrate the basic concepts of grid computing.
- To provide grid architecture.
- To expose open grid service in architecture.
- To introduce necessary fundamentals those enable the students for advanced studies in the area of grid computing.
- To illustrate the grid computing technologies.
- To expose open grid service in infrastructure.

MODULE I INTRODUCTION TO GRID COMPUTING**15**

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

MODULE II GRID COMPUTING TECHNOLOGIES**15**

Open Grid Service Architecture (OGSA) – OGSA Basic Services – Open Grid Services infrastructure (OGSI). – Globus Tool kit – Grid Technologies, Systems and Scheduling.

L-15; P-30**REFERENCES :**

1. SohaMaad, "Grid computing –Technology and Applications, Widespread Coverage and New Horizons", ISBN 978-953-51-0604-3, InTech chapters, 2012.
2. D.Janakiram, "Grid Computing Models", 1st Edition, Tata McGraw-Hill Education, ISBN-10 70600961, 2005.
3. Joshy Joseph, Craig Fellenstein, "Grid Computing", 1st Edition, ISBN :0-13-145660-1, IBM Press, 2009.

OUTCOMES :

Students who complete this course will be able to

- Apply the technologies such as high-speed links and storage area networks for building computational and data grids.
- Apply the new ideas to solve open problems in distributed computing applications.

- Identify the computational and data grids.
- Identify the dynamic virtual organization and distributed shared memory in Grid.
- Identify the open grid services in grid computing.
- Utilize grid computing and cluster computing middleware, such as Globus Tool kits and HPC Portals for implementing virtual super computing resources.

ECC6121 ADVANCED EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To explore Embedded system lifecycle
- To Introduce the occurrence of shared data problem in embedded systems
- To describe need for power management techniques in embedded systems
- To familiarize the debugging in embedded systems

MODULE I EMBEDDED DESIGN LIFE CYCLE 09

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs Micro Controller – Performance tools – Benchmarking –RTOS Micro Controller – RTOS availability – Tool chain availability – Other issues in selection processes.

MODULE II EMBEDDED HARDWARE AND SOFTWARE 09

Review of basics in embedded hardware and software– Hardware software co design- Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency – Interrupt routines in an RTOS environment –Hard Real Time scheduling considerations - Embedded platform boot sequence.

MODULE III MEMORY AND INTERFACING 09

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing - communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access– Arbitration -Multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols.

**MODULE IV INTEGRATION AND TESTING OF EMBEDDED
HARDWARE AND FIRMWARE 09**

Integration of Hardware and Firmware-In system programming-The Integrated development environment-Debugging techniques- Host based debugging – Remote debugging – ROM emulators – Logic analyzer- Real time trace – Hardware break points – Overlay memory- Testing embedded software

MODULE V POWER OPTIMIZATION TECHNIQUES IN EMBEDDED SYSTEMS**09**

The power profile of an Embedded Computing Systems – Constant versus Dynamic power – A simple model of power efficiency –Advanced Configuration and Power Interface –ACPI system states- Case Study- power optimization techniques in wireless sensor networks.

Theory 45**REFERENCES :**

1. Arnold S. Berger – “Embedded System Design: An introduction to processor,tools and techniques”, CMP books, USA, 2002.
2. David. E. Simon, “An Embedded Software Primer”, Pearson Education, 2001.
3. Frank Vahid and Tony Givargis ‘Embedded Systems Design: A UnifiedHardware/Software Introduction’, John & Wiley Publications, 2002.
4. Peter Barry, Patrick Crowley, “Modern Embedded Computing” MorganKaufmann Publishers, 2012.

OUTCOMES :

Students who complete this course will be able to

- Analyze the quality principles and tools in embedded system during product development process
- Analyze the division of hardware/software in embedded systems.
- Develop the interrupt routines in RTOS environment
- Design energy efficient embedded systems
- Design interface circuit with processor and peripheral devices
- Test and debug the coding in embedded systems

EVEN SEMESTER ELECTIVES LIST

CSCY210	PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn the basics of pervasive computing and systems
- To explain the role of pervasive networks and communications
- To provide exposure to latest technologies such as wearable computing and smart identification which relate to pervasive computing
- To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area
- To design successful mobile and pervasive computing applications and services
- To give practical experience in the area through the design and execution of a modest research project

MODULE I INTRODUCTION 09

Prototyping – The Internet of Things: an Overview - Design Principles for Connected Devices- Internet Principles-Calm and Ambient Technology-Web Thinking for Connected Devices- Internet Principles- -DNS-Static IP address Assignment-Dynamic IP address Assignment-IPv6-MAC addresses-TCP and UDP Ports-An Example: HTTP Ports-Other Common Ports-Application Layer Protocols-HTTP-HTTPS-Encrypted HTTP-Other Application Layer Protocols

MODULE II TOOLS AND TECHNOLOGIES 09

Pervasive Learning – Emerging Technologies and Systems for Pervasive Learning- Integration of Real-World Practice and Experience with Pervasive Learning- Nature of Pervasive Learning and Provision of Well-Being in Education- Service Management in Pervasive Computing Environments- Service Management in Pervasive Computing Environments- Techniques for Service Management in PvCE- Service Composition-Standards and Implementation of Pervasive Computing Applications

MODULE III SECURITY AND PRIVACY 09

Security and Privacy in Pervasive Networks – Security Classics- Hardening Pervasive Networks- Privacy in Pervasive Networks- Understanding Wormhole Attacks in Pervasive Networks- A Wormhole Attack- Severity of a Wormhole Attack- Classification of Wormholes- Wormhole Attack Modes- Mitigating

Wormhole Attacks- Discussion of Some Mitigating Solutions to Avoid Wormhole Attacks

MODULE IV NETWORKING AND COMMUNICATION

09

Autonomic and Pervasive Networking – Ubiquitous/Pervasive Networks- Applying Autonomic Techniques to Ubiquitous/Pervasive Networks- Self-* (star) In Autonomic and Pervasive Networks- Autonomic and Pervasive Networking Challenges- An Adaptive Architecture of Service Component for Pervasive Computing- Motivation- An Overview of the Delaying Adaptation Tool- Case Study

MODULE V QUALITY OF SERVICE

09

The Coverage Problem - Stochastic k-Coverage Protocol- Performance Evaluation of Pervasive Networks Based on WiMAX Networks- IEEE 802.16 Architecture and QoS Requirements- Proposed QoS Framework- Implementation Frameworks for Mobile and Pervasive Networks- Correlating Design to Implementations- Challenges for Implementation Frameworks- State of the Art in Implementation Frameworks

Theory : 45

REFERENCES :

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", 1st, Wiley, ISBN: 9781118430620, 2014.
2. Mohammad S. Obaidat, Mieso Denko And Isaac Woungang, "Pervasive Computing and Networking", Wiley, ISBN: 9780470747728, 2011.
3. Asoke K Talukder, Hasan Hasan Ahmed and Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd Edition, Tata McGraw-Hill Education Private Limited, 9780070707313, 2011.

OUTCOMES :

Students who complete this course will be able to

- Describe the concept of pervasive computing
- Design a basic architecture for a pervasive computing environment
- Analyze the role of sensors in Wireless networks
- Relate to current trends in pervasive computing and develop a sense of their practicality.
- Evaluate important issues and concerns on security and privacy
- Deploy the location and context information for application development

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. Tsihrantzis, 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.

CSCY221 DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide tools and techniques to model a distributed system principal models and to acquire knowledge on how to model a distributed system.
- To introduce the higher level abstractions such as distributed file systems and peer-to-peer networks.
- To highlight the important issues pertaining to distributed environments.
- To explore the distributed objects used for communication.
- To gather knowledge on transactions and recovery measures.
- To develop skills on the design and implementation of distributed models based on case studies.

MODULE I INTRODUCTION TO DISTRIBUTED SYSTEMS 09

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

MODULE II DISTRIBUTED OBJECTS 09

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

MODULE III DISTRIBUTED FILE SYSTEMS 09

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

MODULE IV DISTRIBUTED TRANSACTIONS 09

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

MODULE V DISTRIBUTED SHARED MEMORY 09

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

Theory : 45

REFERENCES :

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems concepts and Design", 5th Edition, Pearson Education, ISBN 978-0-13-214301-1, 2012.
2. Sukumar Ghosh, "Distributed Systems: An algorithmic approach", 2nd edition, CRC Press, ISBN no: 978-1-4665-5297-5, 2014.

OUTCOMES :

Students who complete this course will be able to

- Acquire the ability to apply knowledge of distributed concepts to design and develop a solution for a given distributed application.
- Apply the concepts in the design of distributed application.
- Model connection-oriented and connectionless communication in 2 tier Client Server architecture.
- Differentiate between client centric and data centric consistency models
- Describe the protocols for implementing consistency models and updating replicas in a Distributed System.
- Gain knowledge on the design and implementation based on case study models.

CSCY222 IT SYSTEMS MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES :

- To focus on the importance of information systems management and their leadership issues
- To provide knowledge on the Technologies for developing and managing information resources and systems
- To expose how to systems for supporting knowledge based work process
- To design how to manage essential technologies and system development
- To enable how to plan disaster recovery and exception management
- To support decision making followed by the challenges ahead for rising Societal risks of IT and messaging

MODULE I INTRODUCTION OF INFORMATION SYSTEM 09

Importance of information systems management- History - The organizational environment - The Role of Information Systems in Business Today-Perspectives on Information Systems-Contemporary Approaches to Information Systems-Management Decision Problems-Technology environment

MODULE II MANAGING THE ESSENTIAL TECHNOLOGIES 09

Development strategy -Basic concepts –Baselines – Strategic uses of information technology – Information systems planning-Distributed systems -Global E-Business and Collaboration-Business Processes and Information Systems-Business Processes.

MODULE III MANAGING SYSTEM DEVELOPMENT 09

Defining the requirements – Understanding Ethical and Social Issues Related to Systems - A Model for Thinking About Ethical, Social, and Political Issues - Technologies for developing systems – Management issues in system development

MODULE IV IT INFRASTRUCTURE AND EMERGING TECHNOLOGIES 09

IT Infrastructure - Infrastructure Components - Contemporary Hardware Platform Trends - The Emerging Mobile Digital Platform - Contemporary Software Platform Trends - Management Issues - Case study.

MODULE V SECURING INFORMATION SYSTEMS**09**

System Vulnerability and Abuse - Business Value of Security and Control - Establishing a Framework for Security and Control - Technologies and Tools for Protecting Information Resources

Theory 45**REFERENCES :**

1. Kenneth C. Laudon and Jane P. Laudon,"Management Information Systems Managing The Digital Firm", Prentice Hall-Pearson , ISBN-13: 978-0-13-214285-4,2012.
2. Barbara Mc Nurlin, Ralph Sprague and Tung Bui," Information systems management in practice", 8th Edition, Prentice Hall, ASIN: B00IZ0BH5E, 2013.
3. Kenneth C. Laudon , Jane P. Laudon "Management Information System", Pearson Education; Fourteenth edition, ISBN-13: 978-9332548909,2016.
4. Rich Schiesser "IT Systems Management: Designing, Implementing and Managing World - Class Infrastructures", Prentice Hall India Learning Private Limited; 2nd edition, ISBN-13: 978-9332550193,2015.
5. Rajaraman.V "Introduction to Information Technology", Prentice Hall India Learning Private Limited; 2nd edition edition, ISBN-13: 978-8120347311, 2013.

OUTCOMES :

Students who complete this course will be able to

- Select and apply bullet-proof processes in areas ranging from change management to production acceptance.
- Realize technology environment and information systems planning.
- Use appropriate technology for managing operations and systems more efficiently and effectively.
- Apply information resources to develop systems for supporting knowledge
- Demonstrate software administration and performance.
- Gain knowledge on effective applications of information systems in business

CSCY223 TEAM SOFTWARE PROCESS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide a comprehensive introduction to term software development.
- To expose the students to realistic team work problems and give a practical
- To experience teamwork
- To familiar with interactive how to manage team project and processes
- To master how to plan a development plan and software inspections
- To design and implantation about software testing for product

MODULE I INTRODUCTION AND THE TEAM ROLES 09

TSP Principles-TSP Process Elements and Measures-TSP Quality Practices-Team Foundations-Team Types, Styles, and Dynamics-Team Member Responsibilities-Team leader role - Team Member Roles-Team Leader Role.

MODULE II PROJECT PLANNING WITH TSP 09

Change Management Fundamentals-Preparing Management and Teams for TSP Implementation-Project Implementation and Tracking with TSP-The TSP Launch Meetings- System Building -Releases- Development plan - Software inspections.

MODULE III DESIGNING AND DEVELOPMENT 09

Defining the requirements –Checkpoints- Conceptual Design- Risk Management-Designing with teams – The Strategic Script- Design standard-Design for Reuse Communicating with Stakeholders-Replanning.

MODULE IV INTEGRATED TESTING AND IMPLEMENTATION 09

Data Recording-Gathering and Using Size Data-Gathering and Using Schedule Data-Testing Principles-Test Planning-Tracking and measuring testing- -The Postmortem-The process Improvement Proposal -Gathering and Using Quality Data.

MODULE V MANAGING A TEAM 09

Scaling Up the TSP-Organizational Implementation- The team leader skill and abilities-The team leader Project Activities -TSP Process Variations-Large-scale TSP Teams- Teamwork- Case Study.

Theory 45

REFERENCES :

1. Frank Tsui , Orlando Karam “Essentials Of Software Engineering 3rd Edition, Jones & Bartlett Learning , ISBN-13: 978-1449691998, 2013.
2. Watts S Humphrey,” Introduction to the Team Software Process”, Boston MA: Addison – Wesley, ISBN-10: 8177581414,ISBN-13: 978-8177581416,2009.
3. Watts S. Humphrey,Timothy A. Chick and William Nichols “Team Software Process”, Software Engineering Process Management,2010.
4. Roger S Pressman, “Software Engineering: A practitioner’s Approach”, 7th edition, R.S. Pressman and Associates, ISBN-13: 978-0071267823, 2009.
5. Capers Jones, "Software Engineering Best Practices: Lessons from Successful Projects in the Top Companies", McGraw-Hill Education; 1 edition ,ISBN-10: 007162161X ISBN-13: 978-0071621618, 2009.

OUTCOMES :

Students who complete this course will be able to

- Explain role of team software process in programming.
- Describe role of team manager in software development
- Apply principles of TSP for effective software development
- List the conflicts that undermine Team work.
- Support the team and the individuals on the team as the process expert
- Map TSP to CMMI practices

CSCY224 USER INTERFACE DESIGN

L	T	P	C
1	0	2	2

OBJECTIVES :

- To learn the prototyping and testing of user interfaces
- To identify the importance of iterative design in producing usable software
- Comprehend the techniques for evaluating the usability of an interface
- To identify the needs of user in UID
- To expose to content awareness and information architecture
- To showcase challenges and opportunities in social media space for UID

MODULE I UNDERSTANDING USER AND CONTENT 15

Introduction about User Research – User Motivation – Patterns(User Perspective) – Organizing content – Information Architecture – Big Picture – Feature/Search/Browse – Dashboards – News Streams- Picture boards – Alternative views. Staying Found – Cost of Navigation – Navigational Models – Entry/Exit Points – Menus – Sitemaps- Sequence Maps. Basis for information graphics – Data organization models – Patterns for Data organization - Getting user inputs – Patterns for inputting data.

MODULE II NAVIGATION AND ADVANCE CONCEPT 15

Animated Transition – Scrollbars – Organizing the page – Layout of Page elements – Actions performed on things – actions patterns.Social media considerations of UID – Interaction patterns for Social Media – Mobile and Device Responsive Designs.

L-15; P-30**REFERENCES :**

1. Jenifer Tidwell, "Designing Interfaces - Patterns for Effective Interaction Design", 2nd Edition, ISBN-13: 978-1449379704, 2011.
2. Ben Shneiderman, "Design the User Interface", 5th Edition, Pearson Education, ISBN: 978-81-317-3255-7, 2009.

OUTCOMES :

Students who complete this course will be able to

- Apply design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem
- Design a usable and compelling user-interface for given set of requirements

- Conduct an evaluation of a user-interface by employing a series of evaluation Methods.
- Appreciate and understand the nuances in UI designing for different user groups.
- Identify the need for strong content/information architecture for good UI experience
- Exhibit awareness for the constant flux in technology space which impacts UID

CSCY225 MULTIMODAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the concept of multimodal systems and interfaces.
- To make them understand the importance of audio attention modeling and recognition.
- To give good rearing on the issues in the design multimodal system.
- To expose to essential techniques for implementing multimodal systems
- To create awareness of associated security considerations
- To introduce relevant human computer interaction aspects

MODULE I INTRODUCTION TO MULTIMODAL SYSTEMS 09

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

MODULE II AUDIO ATTENTION MODELLING AND DATA FUSION 09

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

MODULE III AUDIO RECOGNITION AND CLASSIFICATION 09

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

MODULE IV ISSUES IN THE DESIGN AND IMPLEMENTATION 09

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

MODULE V HCI AND SECURITY ASPECTS 09

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

Audio scene analysis – Source localization - Source separation - Performance analysis and comparison – Case Study involving Gesture recognition.

Theory : 45

REFERENCES :

1. PradiptaBiswas, Carlos Duarte, Patrick Langdon, Luis Almeida, Christoph Jung, "A Multimodal End-2-End Approach to Accessible Computing", 1st Edition, Springer, ISBN: 1447167082, 2013.
2. P. Maragos, A. Potamianos, P. Gros, "Multimodal Processing and Interaction: Audio, Video, Text", Springer, ISBN: 0471741094, 2010.
3. D. Wang, G. Brown, "Computational Auditory Scene Analysis: Principles, Algorithms, and Applications", Wiley - IEEE Press, ISBN: 0471741094, 2006.

OUTCOMES :

Students who complete this course will be able to

- Identify the strengths and weaknesses of multimodal interfaces by proper comparison of different types.
- Exhibit understanding and appreciation for needed for multimodal access
- Comparatively analyses different facets of multimodal system development
- Evaluate varied access methodologies provided by multimodal systems
- Apply the human-computer interaction interfaces in employing new interaction techniques for restricted tasks.
- Analyze and understand the various the security issues in the design and implementation of multimodal system tools.

CSCY226 ONLINE COURSE MANAGEMENT SYSTEM

L	T	P	C
1	0	2	2

OBJECTIVES :

- To explicate the basics of content management in web
- To analyze the design issues in a CMS
- To provide insight about design of a course and its evaluation process in CMS
- To appreciate the CMS System
- To expose the future of CMS system
- To enable students to establish a course in a learning management system

MODULE I ESSENTIALS OF COURSE MANAGEMENT SYSTEM 15

Introduction to content management-value and ROI of content- content in a knowledge economy - content strategy-nature,formats of a content- defining module types-reusing modules-.design verses technology-content centric & learner centric design- design challenges- Learner motivation- designing a web conference-design and development of web-based courses-developing student participation-self-learning design-monitoring and evaluation-future of course Management system.

MODULE II BUILDING A COURSE**15**

Preparing the workspace-creating user accounts-assigning course roles-site settings for course designers-Planning course: Learning outcomes-Universal design-resources and activities-types of assessment-course organization-content delivery-Designing self-paced independent courses-developing Cohort-based courses-creating student centered project based courses-Building a knowledge-based online community.

L-15; P-30**REFERENCES :**

1. Sven-Michael Wundenberg, "Requirement Engineering for Knowledge-Intensive Processes: Reference Architecture for the selection of a Learning Management System", Springer, ISBN 13: 9783658088316, 2015.
2. Rahel Anne Bailie, Noz Urbina, "Content Strategy: Connecting the dots between business, brand, and benefits", XML press, ISBN: 9781937434168, 2013.

3. Michael G. Moore, "Distance Education: A Systems View of Online Learning", 3rd edition, Greg Kearsley Cengage Learning, ISBN-13: 9781111520991, 2011.
4. Michael W. Allen, "Michael Allen's Guide to E-Learning: Building Interactive, Fun, and Effective Learning Programs for Any Company" John Wiley & Sons, ISBN: 978-0-471-20302-5, 2013.
5. Colleen Carmean, Ali Jafari, "Course Management Systems for Learning: Beyond Accidental Pedagogy", ISBN: 1591405122, 9781591405122, 2005.
6. Susan Smith Nash, Michelle Moore, "Moodle Course Design Best Practices", 1st edition, Packt publishing, 2014, ISBN: 978-1-78328-681-2.
7. Ryan John, "Canvas LMS Course Design", 1st edition, Packt publishing, ISBN: 978-1-78216-064-9, 2014.

OUTCOMES :

Students who complete this course will be able to

- Recall the fundamentals of content management
- Analyze the basics of associated with the design of CMS
- Design a CMS and evaluate it
- Comprehend the current trends in CMS system
- Expose to the future of the CMS system
- Analyze the issues with the design of courses and take appropriate decisions

ITC6201 CLOUD COMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To gain understanding of the basic concepts of cloud computing.
- To learn various types of cloud services, technologies and service providers.
- To know the design challenges of cloud infrastructure.
- To have knowledge about different programming models and cloud software.
- To understand the privacy and security issues in cloud environments.

MODULE I CLOUD COMPUTING BASICS**09**

Introduction to Cloud Computing – Cloud computing reference model- Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -Cloud computing vendors .

MODULE II CLOUD COMPUTING TECHNOLOGY**08**

Virtualization-Types of virtualization-Virtualization and cloud computing- Client-thin, thick, mobile clients- Cloud Providers and Consumers-Variou Cloud Services- Accessing the Cloud- Frameworks- AJAX, Python- Web Hosting Services- Web Applications- Web API's and Web Browsers.

MODULE III CLOUD INFRASTRUCTURE**10**

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development– Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE IV PROGRAMMING MODEL**10**

Map Reduce programming model - Map reduce and extensions - Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - GFS and HDFS –Cloud platforms in Industry – Google App Engine, Amazon AWS- Cloud Software Environments -Eucalyptus, Open Nebula.

MODULE V SECURITY IN CLOUD**8**

Cloud security fundamentals- Privacy and Security in cloud - Software-as-a-Service Security Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

Theory 45

REFERENCES :

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw-Hill, 2010.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms" John Wiley & Sons, Inc Publications, 2011
5. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw-Hill Education Private Ltd., 2013
6. Tim Malhar, S. Kumaraswamy, Shahed Latif, "Cloud Security & Privacy", O'Reilly media, 2009.

OUTCOMES :

On completion of the programme students will be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Discuss the cloud technologies including virtualization and web based technologies.
- Explain the cloud file systems and their applications in industry.
- Explain the core issues of cloud computing such as security, privacy and interoperability

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, Wrocz, 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 tools 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 evaluate 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, TECHNOLOGY & 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.

L	T	P	C
3	0	0	3

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

L	T	P	C
3	0	0	3

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 – Trans 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 Mifflin 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 Matlab 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