CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

COMPUTER SCIENCE AND ENGINEERING

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

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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.

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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.

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PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Computer Science and Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

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

PROGRAMME OUTCOMES

On completion of the programme the graduates will

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

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

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

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

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

iii. "Institution" means B.S. Abdur Rahman Crescent Institute of Scienceand 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. AbdurRahman 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. AbdurRahman Crescent Institute of Science and Technology, who looks after the welfare and discipline of the students.

vii. "Controller of Examinations" means the Controller of Examinationsof B.S. Abdur Rahman Crescent Institute of Science and Technology, who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

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

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

2.2 Modes of Study

2.3.1 Full-time

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

2.3.2

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

2.3.3 Part-time

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

2.3 Admission Requirements

2.3.1

Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this 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.

2.3.2

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

2.3.3

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

2.3.4

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

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

3.1

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

Programme	Min. No. of Semesters	Max. No. of Semesters
M. Tech. (Full Time)	4	8
M. Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.C.A. (Part Time)	9	18
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.C.A. (Part Time) – (Lateral Entry)	6	12
M.Sc. (Full Time)	4	8
M. Sc. (Part Time)	6	12

3.2

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

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

3.3

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

3.4

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

3.5

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

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01	Civil Engineering	M. Tech. (Structural Engineering)	B.E / B. Tech. (Civil Engineering) / (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)	
02	Mechanical Engineering	M. Tech. (Manufacturing Engineering)	B.E. / B. Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M. Tech. (CAD/CAM)	
03	Polymer Engineering	M. Tech. (Polymer Technology)	B. E. / B. Tech. Mechanical / Production /Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry)
04	Electrical and Electronics Engineering	M. Tech. (Power Systems Engg)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (Power Electronics & Drives)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
05	Electronics and Communication Engineering	M. Tech. (Communication Systems)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / Electronics / E&I / I&C / EEE)
06	ECE Department jointly with Physics Dept.	M. Tech. (Optoelectronics and Laser Technology)	B.E. / B. Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics)
07	Electronics and Instrumentation Engineering	M. Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE / ICE / Electronics / ECE / EEE)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
08	Computer Science and Engineering	M. Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Software Engineering)	B.E. / B. Tech. (CSE / IT) MCA
		M. Tech. (Network Security)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Computer Science and Engineering with specialization in Big Data Analytics)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
09	Information Technology	M. Tech. (Information Technology)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
		M. Tech. (Information Security & Digital Forensics)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
10	Computer Applications	M.C.A.	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		M.C.A. – (Lateral Entry)	B.Sc Computer Science / B.Sc Information Technology / B.C.A
		M. Tech. (Systems Engineering and Operations Research)	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
		M. Tech. (Data & Storage Management	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
11	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study.
		M.Sc. Mathematics	B.Sc. (Mathematics)
12	Physics	M.Sc.(Physics)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
		M.Sc. (Material Science)	B.Sc.(Physics / Applied Science / Electronics / Electronics

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

3.6

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

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

3.7

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

- One credit for one lecture period per week (or) 15 periods per semester
- One credit for one tutorial period per week
- One credit each for seminar/practical session/project of two or three periods per week
- One credit for two weeks of industrial internship
- One credit for 15 periods of lecture (can even be spread over a short span of time)

3.8

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

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

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

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

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

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

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

3.14 Industrial internship, if specified in the curriculum shall be of not less than twoweeks duration and shall be organized by the Head of the Department.

3.15 Project Work / Thesis / Dissertation

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

3.15.2 A student may however, in certain cases, be permitted to work for theproject in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from

the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

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

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

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

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

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 Class Advisor

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

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

4.2 Faculty Advisor

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

5.0 CLASS COMMITTEE

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

i. Teachers of all courses of the programme

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

iii. Minimum two students of the class, nominated by the Head of the Department.
iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member
v. Professor in-charge of the PG Programme - Ex-Officio Member.

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

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

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

6.0 COURSE COMMITTEE

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

7.0 REGISTRATION AND ENROLMENT

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

7.2 For the subsequent semesters registration for the courses will be done by the student one week before the last working day of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should

consult his/her Faculty Advisor for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Advisor.

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

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

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

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

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

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

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

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

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

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

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

Programme	Minimum No. of credits to be earned to enroll for project semester
M. Tech. (Full time / Part time)	18
M.C.A. (Full time / Part time)	45
M.C.A. (Full time / Part time) – (Lateral Entry)	22
M.Sc.(Full time / Part time)	18

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

10.0 DISCIPLINE

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

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

11.0 ATTENDANCE

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

11.2 Ideally every student is expected to attend all classes and earn 100%attendance in the contact periods of every course, subject to a maximum relaxation of 25% for genuine reasons like on medical grounds, representing the 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.

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

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

12.0 SUMMER TERM COURSES

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

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

12.3 The number of contact hours and the assessment procedure for any courseduring summer term will be the same as those during regular semesters. Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters, if they wish to improve their continuous assessment marks subject to the approval of the Head of the department.

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

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

13.0 ASSESSMENTS AND EXAMINATIONS

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

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

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

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

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

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

14.0 WEIGHTAGES

14.1 The following shall be the weightages for different courses:

i)	**Lecture based course**	
	Two continuous assessments	50%
	Semester-end examination	50%
ii)	**Laboratory based courses**	
	Laboratory work assessment	75%
	Semester-end examination	25%
iii)	**Project work**	
	Periodic reviews	50%
	Evaluation of Project Report by	
	External Examiner	20%
	Viva-Voce Examination	30%

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

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

15.0 SUBSTITUTE EXAMINATION

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

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

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

16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

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

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

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

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

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

17.0 AWARD OF LETTER GRADE

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

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

18.0 DECLARATION OF RESULTS

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

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

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

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

19.0 COURSE REPETITION AND ARREARS EXAMINATION

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

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

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

19.4 If any student obtained“U”or“AB”grade, the marks earned during the redo

period for the continuous assessment for that course will be considered for further appearance as arrears.

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

20.0 GRADE SHEET

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

the credits for each course registered for that semester.

the performance in each course by the letter grade obtained.

the total credits earned in that semester.

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

20.2 The GPA will be calculated according to the formula

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

where n = number of courses

where C_i is the number of credits assigned for i^{th} course GP_i - Grade point obtained in the i^{th} course

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

„I" and „W" grades will be excluded for GPA calculations.

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

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

20.3.1 For students under full time mode of study

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

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

20.3.2 For students under part time mode of study

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

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

21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

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

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

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

21.2 The award of the degree must be approved by the 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. (Computer Science and Engineering)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6181	Applied Algebra and Discrete Algorithms	**3**	**1**	**0**	**4**
2	CSC6101	Advanced Computer Architecture	**3**	**1**	**0**	**4**
3	CSC6102	Algorithm Design and Implementation	**3**	**0**	**2**	**4**
4	CSC6103	Computer Networks and Management	**2**	**0**	**2**	**3**
5	CSC6104	Distributed Operating System	**3**	**0**	**0**	**3**
6	CSC6105	Advanced Software Engineering	**3**	**0**	**0**	**3**
7	CSC6106	Case Study 1	**0**	**0**	**2**	**1**
						22
		SEMESTER II				
1	ECC6203	Research Methodology For Electronics Engineers	**3**	**1**	**0**	**4**
2	CSC6201	Machine Learning Techniques	**2**	**0**	**2**	**3**
3	CSC6202	Applied Cryptography &Network Security	**3**	**0**	**2**	**4**
4		Professional Electives #				**9**
						20
		SEMESTER III				
1	CSC7102	Internship* / Term paper	**0**	**0**	**2**	**1**
2		Professional Electives ##				**9**
3		General Elective	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
4	CSC7101	Project – Phase I	**0**	**0**	**12**	**6**
						13
		SEMESTER IV				
1	CSC7101	Project – Phase II	**0**	**0**	**36**	**18**
						6+18=24
		TOTAL CREDITS				**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 ELECTIVES

Sl. No.	Code	Course Title	L	T	P	C
		LIST OF ODD SEMESTER ELECTIVES				
1	CSCY101	Data warehousing and Data mining	**3**	**0**	**0**	**3**
2	CSCY102	Agent Based Intelligent Systems	**1**	**0**	**2**	**2**
3	CSCY103	Human Computer Interaction	**3**	**0**	**0**	**3**
4	CSCY104	Cognitive Science	**3**	**0**	**0**	**3**
5	CSCY105	Deep Learning	**3**	**0**	**0**	**3**
6	CSCY106	Computer Vision	**3**	**0**	**0**	**3**
7	CSCY107	Statistical Natural Language Processing	**2**	**0**	**2**	**3**
8	CSCY108	Component Based Technology	**2**	**0**	**2**	**3**
9	CSCY109	Mobile Computing	**1**	**0**	**2**	**2**
10	CSCY110	Digital Image Processing	**3**	**0**	**0**	**3**
11	CSCY111	Bio Inspired Algorithms	**3**	**0**	**0**	**3**
12	CSCY112	Software Design And Architecture	**3**	**0**	**0**	**3**
13	CSCY113	Wireless Networks	**3**	**0**	**0**	**3**
12	ECCY009	Internet of Things	**3**	**0**	**0**	**3**
13	ECC6121	Advanced Embedded Systems	**3**	**0**	**0**	**3**
		LIST OF EVEN SEMESTER ELECTIVES				
1	CSCY201	Software Testing and Quality Assurance	**3**	**0**	**0**	**3**
2	CSCY202	Mobile Adhoc Networks	**3**	**0**	**0**	**3**
3	CSCY203	Performance Evaluation of Computer Systems and Networks	**3**	**0**	**0**	**3**
4	CSCY204	Advanced Databases	**3**	**0**	**0**	**3**
5	CSCY205	Real Time Systems	**3**	**0**	**0**	**3**
6	CSCY206	Multicore Programming	**3**	**0**	**0**	**3**

7	CSCY207	Software Project Management	**3**	**0**	**0**	**3**
8	CSCY208	Dependable Computing	**3**	**0**	**0**	**3**
9	CSCY209	Advanced Graphics Programming	**3**	**0**	**0**	**3**
10	CSCY210	Pervasive Computing	**3**	**0**	**0**	**3**
11	CSCY211	Web Technology	**1**	**0**	**2**	**2**
12	CSCY212	XML and Web Services	**1**	**0**	**2**	**2**
13	CSCY213	Multimedia Systems	**1**	**0**	**2**	**2**
14	ITC6201	Cloud Computing Technologies	**3**	**0**	**0**	**3**

LIST OF SINGLE CREDIT ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
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**
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

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

OBJECTIVES :

The aim of this course is to

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

MODULE I INTEGERS, COMPUTER ALGEBRA AND CODES 09+03

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

MODULE IILOGIC 09+03

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

MODULE III MODELING, COMPUTATION AND LANGUAGES 09+03

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

MODULE IV GRAPH THEORY 09+03

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

MODULE V CIPHERS 09+03

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

L – 45; T – 15

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

At the end of the course students will be able to

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

CSC6101 ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	1	0	4

OBJECTIVES :

- To understand the functional requirements and their role in the system design
- To understand the various parameters that contribute to the performance of a computer system and the technology of achieving the best performance through these parameters
- To acquire essential knowledge to measure or predict system performance
- To understand how the memory hierarchy and optimization contribute to the performance of the system
- To understand the approaches in designing a new system through Instruction level parallel processing and to improve the Performance overcoming the hazards-meeting the functionality.
- To understand the data level parallel processing and Vector Processing for performance

MODULE I FUNDAMENTALS OF COMPUTER DESIGN 09+04

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

MODULE IIMEMORY HIERARCHY DESIGN 09+03

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

MODULE III INSTRUCTION LEVEL PARALLELISM 09+03

Concepts of ILP - Pipelining and hazards –Compiler techniques for exposing ILP- Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: lP6 Micro architecture. Compiler techniques for exposing ILP - Static branch prediction - Static multiple issues: VLIW - Advanced compiler support –Hardware VS software speculation.– Case study: Intel core i7 and ARM Cortex-A8

MODULE IV DATA-LEVEL PARALLELISM 09+02

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

MODULE VTHREAD LEVEL PARALLELISM 09+03

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

L – 45; T – 15

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSC6102 ALGORITHM DESIGN AND IMPLEMENTATION

L	T	P	C
3	0	2	4

OBJECTIVES :

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

MODULE I INTRODUCTION 09

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

MODULE IIGRAPH ALGORITHMS 09

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

MODULE III DIVIDE-AND-CONQUERANDRANDOMIZED ALGORITHMS 09

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

MODULE IV MULTITHREADED AND NUMBER-THEORETIC ALGORITHMS 09

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

MODULE V NP-COMPLETENESS AND APPROXIMATION ALGORITHMS 09

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

L – 45; P 30

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

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

CSC6103 COMPUTER NETWORKS AND MANAGEMENT

L	T	P	C
2	0	2	3

OBJECTIVES :

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

MODULE I INTRODUCTION TO COMPUTER NETWORKS 09

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

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

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

MODULE III MECHANISMS FOR QUALITY OF SERVICE AND INTERNET PROTOCOLS 09

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

MODULE IV NETWORK MANAGEMENT AND SNMP 09

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

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

MODULE VRMON, NETWORK MANAGEMENT TOOLS AND APPLICATIONS **09**

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

L-30; P-30

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSC6104 DISTRIBUTED OPERATING SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES :

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

MODULE I PROCESS SYNCHRONISATION 09

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

MODULE IIDISTRIBUTED SYSTEMS 09

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

MODULE III DISTRIBUTED RESOURCE MANAGEMENT 09

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

MODULE IV FAULT TOLERANCE AND RECOVERY 09

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

MODULE V SECURITY 09

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

Theory 45

REFERENCES :

1. MukeshSinghal and Niranjan. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGrawHill, 2011.
2. Andrew S.Tanenbaum and Herbert Bos, “Modern Operating Systems”, 4th Edition, Pearson, ISBN 978-0-13-359162-0, 2015.
3. Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”, 9th Edition, Addison Wesley Publishing Co., ISBN –978-1-11-809375-7, 2012.
4. William Stallings, Moumita Mitra Manna. “Operating Systems – Internal and Design Principles”, 8th Edition, Pearson Education, ISBN978-0-13-380591-8, 2014.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate operating system concepts such as scheduling and synchronization.
- Identify the design and implementation issues with distributed systems.
- Evaluate the scheduling requirements of distributed systems and find their solutions
- Identify the different approaches to fault recovery and the fault tolerance issues.
- Apply methods and tools for resource protection and security.
- Investigate different operating system principles, abstractions, algorithms and techniques.

CSC6105 ADVANCED SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES :

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

MODULE I INTRODUCTION 09

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

MODULE IISYSTEM DEPENDABILITY AND SECURITY 09

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

MODULE IIIADVANCED SOFTWARE ENGINEERING 09

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

MODULE IV SOFTWARE ORIENTED SOFTWARE ENGINEERING 09

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

MODULE V SOFTWARE MANAGEMENT 09

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

Theory 45

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

SEMESTER II

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 IIRESEARCH 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.

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MODULE V: OPTIMIZATIONTECHNIQUES **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
- Analyze and interpret the data
- Report the research findings

CSC6201 MACHINE LEARNING TECHNIQUES

L	T	P	C
2	0	2	3

OBJECTIVES :

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

MODULE I INTRODUCTION TO MACHINE LEARNING 09

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

MODULE IISUPERVISED LEARNING 09

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

MODULE III UNSUPERVISED LEARNING 09

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

MODULE IV PROBABILISTIC GRAPHICAL MODELS 09

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

MODULE V APPLICATIONS 09

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

L-30; P-30

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSC6202 APPLIED CRYPTOGRAPHY AND NETWORK SECURITY **LT P C 3 0 2 4**

OBJECTIVES :

The Student should

- Have a theoretical understanding of the principles underlying cryptography and cryptanalysis.
- Have a fundamental understanding of symmetric and asymmetric encryption, hashing, and digital signatures.
- Learn the basic concepts in networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security.
- Become familiar with the cryptographic techniques that provide information and network security.
- Be able to evaluate the security of communication systems, networks and protocols based on a multitude of security metrics.
- Provide an awareness of network security issues in emerging technologies.

MODULE I CRYPTOGRAPHY AND ENCRYPTION TECHNIQUES 09

Overview – Principles-Concepts –Symmetric and Asymmetric Encryption–AES – Block Cipher Operations– RSA Algorithm – Diffie Hellman Key Exchange

MODULE II DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST 10

Hash Functions – SHA – Message Authentication Codes – Digital Signatures- Key Management and Distribution – X.509 Certificates – Kerberos

MODULE III NETWORK SECURITY 08

Vulnerabilities - Security Assessment, Analysis, and Assurance-Disaster Management – Access Control and Authentication – Authorization

MODULE IV WIRELESS NETWORK SECURITY 08

Wireless Security – Wireless LAN - Smart Phones – PDA – Bluetooth- Broadband Security

MODULE VSECURITY IN EMERGING TECHNOLOGIES 09

Next Generation Mobile Networks – Wireless Sensor Networks – Adhoc Networks – IP based Mobile Networks

L- 45; P-30

REFERENCES :

1. William Stallings, “Cryptography and Network Security – Principles and Practice” 7th Edition, Pearson Education, ISBN No. 978- 0134444284, 2016.
2. Joseph MiggaKizza, “Guide to Computer Network Security” 3rd Edition, Springer Publishers, ISBN No 978-1447166535, 2015.
3. Wolfgang Osterhage, “Wireless Security”, CRC Press, ISBN No. 978-1578087686, 2011.
4. William Stallings, “Network Security Essentials, Applications and Standards”, 5th Edition, Pearson Education, ISBN No.978-0133370430, 2013.
5. John R.Vacca , “Network and System Security”,2nd Edition, Elsevier Publishers, ISBN No.978-0124166899,2014.

OUTCOMES :

Students who complete this course should

- Have a technical understanding of the main cryptographic concepts and technologies available today.
- Explain the requirements and techniques for security management, including security policies, risk analysis, and physical threats and controls.
- Illustrate how cryptography and its application can maintain privacy and security in electronic communications and computer networks.
- Describe the vulnerabilities brought about by modern web-based application and services, and discuss countermeasures.
- Identify the appropriate procedures required to secure networks.
- Innovate techniques for enforcing computer and network security and developing secure e-commerce protocols.

PROFESSIONAL ELECTIVES
LIST OF ODD SEMESTER ELECTIVES

CSCY101DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide students with basic knowledge of tools used for data ware housing.
- To explore the technologies for storing and mining large databases.
- To assess the concepts and methods used for mining the data.
- To explore the strength and weakness of data mining algorithms.
- To expose the use of classification in data mining.
- To explain the application of data warehousing and data mining in real time scenario.

MODULE I INTRODUCTION 09

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

MODULE IIDATA WAREHOUSING AND BUSINESS ANALYSIS 09

Data warehouse –Basic concept-Modeling-Data cube and OLAP, Design and Usage-Frame work, information Processing, Online Analytical Processing-Implementation-Data Generalization.

MODULE III MINING CONCEPTS AND METHODS 09

Mining Basic concepts- Market Basket Analysis-Frequent Itemset - Closed Itemset - Association rules-Mining Methods - Apriori Algorithm-Generating Association rules for Frequent item set-Pattern Mining – Pattern Evaluation Methods

MODULE IV CLASSIFICATION AND CLUSTER ANALYSIS 09

Basic concepts-Decision Tree Induction-Bayes Classification Methods Rule Based Classification-Model Evaluation and selection-Improving classification Accuracy-Cluster Analysis: - Types and Categorization - Partitioning , Hierarchical , Density, Grid, Constraint - and Model-Based Clustering Methods.

MODULE V APPLICATION 09

Case study of the application of data mining in the following field: Financial Data Analysis, Retail Industry, Telecommunication Industry, Biological Data Analysis, Social Network, Scientific Applications, Intrusion Detection

Theory 45

REFERENCES :

1. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, 3rd Edition, ISBN 978-0-12-381479- Morgan Kaufmann Publishers, Elsevier, 2012.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, ISBN: 1-892095-02-5, Pearson education, 2006.

OUTCOMES :

Students who complete this course will be able to

- Distinguish between database and data warehouse.
- Design appropriate data warehouse multi-dimensional model.
- Perform basic data mining operations and apply standard data mining algorithms to solve real time problems
- Correlate data mining techniques to current scenarios in various fields and inculcate the ability to apply tools for mining and analysis.
- Review the various latest research activities going on in the field of Data Mining, thereby creating an interest for research.
- Able to mine the data and perform predictive analysis.

CSCY102 AGENT BASED INTELLIGENT SYSTEMS

L	T	P	C
1	0	2	2

OBJECTIVES :

- To provide basic knowledge of employing intelligent agents in solving complex problems.
- To give the awareness of the building blocks of agents and working of different types of agents.
- To analyze the reasons for uncertainty and ability to design agents to handle them.
- To study the employment of artificial intelligence in recent technologies.
- To represent knowledge in first order and predicate logic.
- To learn about machine learning and planning agent.

MODULE I INTRODUCTION **15**

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

MODULE II INTELLIGENT AGENT **15**

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

L-15; P-30

REFERENCES :

1. Parag Kulkarni, Prachi Joshi, “Artificial Intelligence: Building Intelligent Systems, 1st Edition, PHI, ISBN: 978-81-203-5046-5, 2015.
2. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, ISBN-13: 978-0136042594, 2010.
3. Ngooc Thanh Nguyaaen, Lakhmi C. Jain, “Intelligent Agents in the Evolution of Web and Applications”, 4th Edition, Springer, 2009.

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

COURSE OUTCOMES:

Students who complete this course will be able to

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

CSCY103 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To analyze an interface or device in terms of its usability.
- To define common terms in HCI (e.g. direct manipulation).
- To describe different interaction techniques, including their strengths and weaknesses.
- To use HCI software process.
- To explain Computer components functions regarding interaction with human.
- To demonstrate Understanding of Interaction between the human and computer components.

MODULE I FOUNDATIONS 09

Human: Human memory – Emotion – Individual differences – Psychology and the design of interactive systems – Computer: Devices used for Text entry, display, virtual reality and 3D interactions – Positioning & pointing – physical controls, sensors and special devises – memory – processing and networks. Interactions: Models of interactions - Framework – interaction styles – context of interactions - elements of WIMP interface.

MODULE IIINTERACTION DESIGN BASICS 09

Paradigms of interactions – process of design – HCI in software process - software life cycle – usability engineering – interactive design and prototyping – design rules: principles to support usability – standards – guidelines and rules for heuristics – HCI patterns – implantation support – evaluation technique – user support.

MODULE III IMPLEMENTATION AND EVALUATION 09

Elements of windowing systems – Toolkits – User interface systems – Goals of evaluation – evaluation through expert system, user participation – choosing evaluation method – universal design principles – multi-modal interaction – design focus – user support.

MODULE IV MODELS AND THEORIES-1 09

Cognitive models : Goals and task hierarchies – linguistic models – challenge of display based systems- physical and device models – cognitive architecture –

socio organizational issues and stakeholder requirements: organizational issues – capturing requirements.

MODULE VMODELS AND THEORIES-2 09

Communication and collaboration models: face to face communication – conversion – text based communication – group working – task analysis: task decomposition – knowledge based analysis – dialog notations and design - models of systems – models of rich interactions.

Theory 45

REFERENCES :

1. Julie A. Jacko, “Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications”, 3rd edition, CRC Press, ISBN 9781439829431, 2012.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human computer Interaction”, 3rd edition, Wiley, ISBN-10: 0470665769, 2011.
3. Dix A, Human – Computer Interaction. Harlow, England: Prentice Hall, ISBN- 10:0130461091, 2004.

OUTCOMES :

Students who complete this course will be able to

- Prepare the basics of human and computational abilities and limitations. Formulate the basic theories, tools and techniques in HCI.
- Propose fundamental aspects of designing and evaluating interfaces.
- Practice a variety of simple methods for evaluating the quality of a user interface.
- Apply appropriate HCI techniques to design systems that are usable by people.
- Review various models used for HCI.

CSCY104 COGNITIVE SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To observe the beginning of cognitive science in the areas of linguistics and artificial intelligence.
- To identify the cognitive science as an interdisciplinary field.
- To develop the fundamental skills required for understanding theories, evidence and methods in cognitive science.
- To learn various approaches to artificial intelligence, and the computational modeling of cognitive processes.
- To study the functioning of artificial neurons.
- To gain knowledge in neuroscience and linguistics.

MODULE I INTRODUCTION TO COGNITIVE SCIENCE 09

The prehistory of cognitive science–Extending computational modeling to the brain -Language and micro worlds - Cognitive science and the integration challenge - Tackling the integration challenge–Information Processing Models of The Mind - The Organization of The Mind - Strategies for brain mapping.

MODULE II ARTIFICIAL NEURAL NETWORK AND MACHINE LEARNING 09

Applying the symbolic paradigm - Expert systems, machine learning, and the heuristic search hypothesis - machine learning algorithm - Neural networks and distributed information processing - Neural network models of cognitive processes - Architectures for intelligent agents.

MODULE III LINGUISTIC APPROACH 09

Linguistic Approach - Language and Cognitive Science - The Nature of Language - Language Use in Primates - Language Acquisition - Language Deprivation - Philosophy and Linguistics - Cognition and Linguistics - Neuroscience and Linguistics - Artificial Intelligence and Linguistics.

MODULE IV ARTIFICIAL INTELLIGENCE OPERATIONAL PERSPECTIVE 09

The Practical World of Artificial Intelligence - Approaches to the Design of Intelligent Agents - Machine Intelligence, Knowledge, and Machine Reasoning - Logical Reasoning - Inductive Reasoning – Robotics.

MODULE V APPLICATIONS **09**

Cognitive neuroscience – Evolutionary psychology – Embodied, Embedded and Extended Cognition – Animal Cognition - Case Study.

Theory 45

REFERENCES :

1. Jose Luis Bermudez, Cognitive Science: An Introduction to the Science of the Mind, 2nd Edition, Cambridge University Press, ISBN: 9781107653351, 2014.
2. Keith Frankish, William Ramsey, Cognitive Science, 2nd Edition, Cambridge University Press, ISBN: 9780521691901, 2012.
3. Jay Friedenberg and Gordon Silverman, “Cognitive Science: An Introduction to the Study of Mind, 1stEdition, SAGE Publications, 2006.
4. Mark F. Bear, Barry W. Connors, Michael A. Paradiso, “Neuroscience: Exploring the brain”, 4th Edition, Lippincott Williams and Wilkins Publication, 2016.

OUTCOMES :

Students who complete this course will be able to

- Define what is cognitive science and information processing of mind.
- Apply neural network algorithm for cognitive processes.
- Describe the relationship between cognitive science and linguistic approach.
- Design and implement intelligent agent.
- Apply the cognitive neuroscience to solve research problems. Relate cognitive science with artificial intelligence.

CSCY105 DEEP LEARNING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the basic architecture and statistical approaches for spoken language processing.
- To illustrate how these models are applied to speech recognition and speaker verification.
- To provide knowledge on training the networks constructed based on the mathematical models.
- To introduce Deep Neural Network for modeling complex patterns of speech.
- To learn the fundamental issues in speech recognition.
- To provide an overview on advanced deep models for speech recognition.

MODULE I SPEECH TECHNOLGY 09

Introduction - Recognizing Speech – Reproducing Speech - Scope of Speech Technology – Human Factors - Automatic speech Recognition – Basic Architecture.

MODULE IITRANING NETWORK 09

Deep Neural Networks – Architecture – Parameter Estimation – Practical Considerations – Restricted Boltzman Techniques – Deep Belief Network – Discriminative Pretraining – Hybrid and Dropout Pretraining.

MODULE III NETWORK MODEL 09

DNN-HMM Hybrid System – Key components – Training and Decoding Speedup – Sequence Discriminative Training Criteria – Practical Considerations – Noise Estimation.

MODULE IV REPRESENTATION OF LEARNING NETWORK 09

Feature Representation Learning in Deep Neural Network – Fuse Deep Neural Network – Guassian Mixture Model systems – Adaptation of Deep Neural Networks.

MODULE VADVANCED DEEP MODELS 09

Representation Sharing and Transfer – Multilingual and Cross Lingual Speech Recognition – Multiobjective Training of Neural Network for Speech Recognition –

Robust Speech Recognition Exploiting – Recurrent Neural Network – Related Models – Computational Network.

Theory : 45

REFERENCES :

1. Dong Yu, Li Deng, “Automatic Speech Recognition: A Deep Learning Approach”, Springer, ISBN:978-1-4471-5778-6, 2015.
2. Jack Hollingum, Graham Cassford, “Speech Technology at Work”, Springer, ISBN: 978-3-662-13012-4, 2013.
3. Tuomas Virtanen, Rita Singh, Bhiksha Raj, “Techniques for Noise Robustness in Automatic Speech Recognition”, Wiley, ISBN: 978-1-119-97088-0, 2013.

OUTCOMES :

Students who complete this course will be able to

- Apply appropriate mathematical model for the processing the speech.
- Perform various decompositions and modifications of speech signals.
- Build a complete speech recognition system using the various techniques.
- Apply speech recognition system in areas like military, healthcare, etc.
- Resolve the issues in speech recognition using the various methods.
- Authenticate the identity of the speaker using deep neural network models.

CSCY106 COMPUTER VISION

L	T	P	C
3	0	0	3

OBJECTIVES :

To give introduction on image data and analysis.

To have knowledge on modern mathematics background.

To provide information about cameras , coordinates and calibration. To learn about 3D shape reconstruction method.

To know about stereo matching and feature detection. To gain knowledge on application areas.

MODULE I IMAGE DATA AND ANALYSIS 08

Introduction –Computer vision –Image Data - Images in Spatial domain-Images in frequency domain- Color and Color images – Image Analysis - Basic image topology-Geometric 2D Shape Analysis - Image value analysis

MODULE IIIMAGE SEGMENTATION 09

Basic Example of Segmentation – Mean Shift Segmentation – Image segmentation as an optimization problem – Video segmentation and segment tracking – Camera – coordinates – camera calibration

MODULE III 3-D SHAPE RECONSTRUCTION 09

Cameras – Coordinates – Calibration – 3D shape Reconstruction – Surfaces – Structured Lighting

MODULE IV STEREO MATCHING AND FEATURE DETECTION 09

Stereo matching – Matching, Data cost and confidence – Dynamic programming matching – Third Eye technique – Feature Detection – Invariance, Features and Sets of features – Examples of features.

MODULE VUSEFUL METHODS AND APPLICATIONS 09

Color spaces and segmentation – Binary morphology – 3D perception - Perspective analysis of images – Application scenarios – Industrial quality inspection – Safe Human Robot interaction – Lunar Remote sensing.

Theory 45

REFERENCES :

1. Reinhard Klette,"Concise Computer Vision: An Introduction into Theory and Algorithms", Springer Science & Business Media, ISBN 978-1-4471-6320-6, 2014.
2. Fosyth and Ponce, "Computer Vision: A modern Approach" , 2nd Edition, Prence Hall, ISBN – 10:013608502X, 2011.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications" , Springer, http://szeliski.org/Book, ISBN 978-1-84882-935-0, 2010.
4. Hongyu Guo, "Modern Mathematics and Applications in Computer Graphics and Vision", World Scientific Publishing Co. Pte. Ltd., ISBN 978-9814449328, 2014.
5. Christian Wohler,"3D Computer Vision: Efficient Methods and Applications", 2nd edition, Springer Science & Business Media, ISBN-13: 978-1447141495, 2012.

OUTCOMES :

Students who complete this course will be able to

- Analyze the image data.
- Classify the different image segmentation
- Identify the cameras, coordinates and calibration in computer vision.
- Construct 3D shape stereo images.
- Illustrate stereo matching methods and feature detection.
- Apply concepts of computer vision in various fields.

CSCY107 STATISTICAL NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn the concepts of speech processing and synthesis
- To gain knowledge on syntax and semantics in NLP
- To explain various statistical methods for language processing.
- To describe the Machine translation approaches.
- To explore the language processing in real world application.
- To trace the statistical approaches used in natural language processing.

PREREQUISITES :

- Data Mining

MODULE I WORD AND SPEECH 9

Regular Expressions and Automata - Words and Transducers - N-grams - Partof-Speech Tagging - Hidden Markov and Maximum Entropy Models.

MODULE II SYNTAX, SEMANTICS AND PRAGMATICS 9

Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity - The Representation of Meaning - Computational Semantics- Lexical Semantics- Computational Lexical Semantics.

MODULE III N-GRAMS 9

N-grams Models of Syntax – Counting Words -Unsmoothed N-grams– Smoothing Backoff - Deleted Interpolation–Entropy- English Word Classes– Tagsets for English - Part of Speech Tagging - Rule-Based Part of Speech Tagging -Stochastic Part of Speech Tagging - Transformation-Based Tagging.

MODULE IV Statistical Alignment and Machine 9

Text Alignment- Word Alignment – Statistical Machine Translation

MODULE V MODULE V APPLICATIONS of NLP 9

. Clustering – Information Retrieval – Text Categorization.

L – 45; Total Hours : 45

REFERENCES :

1. NitinIndurkhya, Fred J. Damerau, “Handbook of Natural Language Processing”, 2nd Edition”, CRC Press, ISBN: 9781420085921, 2010.
2. Daniel Jurafsky and James H.Martin, “Speech and Language Processing”,

2nd Edition, Prentice Hall, ISBN: 100131873210, ISBN: 9780262133609, 2009.

3. Christopher D. Manning and HinrichSchütze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, 1999.
4. ImedZitouni, “Natural language processing of semantic language “, Springer, ISBN :97836424535588, 2014.

OUTCOMES :

Students to complete this course will be able to

- Identify the different linguistics components of given sentences.
- Design a tagger to semantically tag words using word tag.
- Implement a parser by providing suitable grammar and words.
- Analyze the statistical machine translation techniques.
- List the various applications of language processing.
- Apply the NLP techniques to real world problems

CSCY108 COMPONENT BASED TECHNOLOGY

L	T	P	C
2	0	2	3

OBJECTIVES :

- To learn the basics of software components design.
- To provide knowledge on how a component is converted by the web service into a service.
- To portray the semantically relation between data and functions inside each component.
- To provide insight knowledge about the various fundamental properties of the components, technology, architecture and middleware.
- To recognize the use of various components based framework for a distributed environment.
- To give an idea that software should be componentized - built from prefabricate components

MODULE I INTRODUCTION 09

Introduction to Software Components - Software Language Engineering - Software Components - Initial Design Considerations - RPC – RMI- MOM - JNI – JAVA BEAN – EJB composing software components : Stateless Component Composition – Tools for Stateless components - CBSD Support - Tools – Debugging Components.

MODULE IIBUILDING INFORMATION MODEL 09

CORBA: Exploring CORBA alternatives - Architecture overview - IDL - ORB - Building an application with CORBA - BIM 2.0 – SOA Pattern for Complex Models – IoT Software Platforms – Advanced SOA for BIM.

MODULE III COMPONENT REALIZATION CONCEPT 09

Big Picture MoCo Template - MoCo Execution Environment - MoCo Service Library - ExplorativePrototyping- MoCo Core API - ISA Architecture

MODULE IV WEB COMPONENTS 09

Web Component –Challenges – Web Component Architecture - UI Core Concepts

–Basics – Z-Index – Building UI –Building Web Components – Widgets - Shadow DOM- Deploying Components with Polymer – Testing Web Components

MODULE VNET ENTITY FRAMEWORK **09**

COM: Object Creation and Destruction Using .NET - Introduction to .NET - Overview of .NET Architecture - Marshalling – Remoting. Introduction - Entity Data Models-Operations - Querying EDMS with Entity SQL - Mapping Stored Procedures- Data Access with ADO.Net.

L-30; P-30

REFERENCES :

1. Mahdi Derakhshanmanesh, Model – Integrating Software Components, Engineering Flexible Software Systems, Springer. ISBN : 978-3-658-09645-8, 2015.Top of Form Bottom of Form
2. Sandeep Kumar Patel, Learning Web Component Development", Packt Publishing 1st Edition, ISBN: 978-1-78439-364-9, 2015.
3. Y Jarrod Overson, Jason Strimpe, "Developing Web Components: UI from JQuery to Polymer", O"Reilly Publications 1st Edition, ISBN: 978-1-491-94902, 2015.
4. Alessandro Del Sole, Top of Form Bottom of Form "Visual Basic 2015" Unleashed, SAMS
5. Dick Hamlet, Top of Form Bottom of Form Composing Software Components: A Software-testing Perspective", Springer, 2010.
6. Thomas J. Mowbray, William A. Ruh, "Inside CORBA", Pearson Education, ISBN: 81-7758-247-6, 2006.
7. Jason Pritchard, "COM and CORBA Side by Side", Pearson Education 5th Edition, ISBN: 978-81-317-0913-9, 2009.

OUTCOMES :

Students who complete this course will be able to

- Apply the principles for building software systems from component based techniques.
- Create reusable widgets or components in web documents and web applications.
- Implement .Net components for the applications.
- Develop or construct software by gluing together prefabricated components.
- Summarize the importance of component information model.
- Use the appropriate testing tools for testing the applications.

CSCY109 MOBILE COMPUTING

L	T	P	C
1	0	2	2

OBJECTIVES :

- To discuss about advanced learning in the field of wireless communication.
- To elaborate upon the basic concepts and principles in mobile computing.
- To expose the students to the concepts of wireless devices.
- To explain the structure and components for Mobile IP and Mobility Management.
- To create awareness about various operating systems available for mobile computing.
- To discuss various issues related to security of mobile computing environment.

MODULE I INTRODUCTION **15**

Mobile Computing- Networks- Application and Services supporting - Developing Mobile Computing Applications-Security in Mobile Computing Mobile Computing Architecture-GSM-Wireless Internet- Wireless Vehicular Networks-Architecture-Vehicular Applications-Standards-Challenges

MODULE IIAPPLICATION DEVELOPMENT **15**

Three tier architecture -Model View Controller Architecture -Memory Management –Information Access Devices –PDAs and Smart Phones –Smart Cards and Embedded Controls –J2ME – Programming for CLDC –GUI in MIDP –Application Development ON Android and iPhone .

L-15; P-30

REFERENCES :

1. Asoke K Talukder, Nuno M. Garcia, Jayateertha G. M, “Convergence Through All-IP Networks”, Pan Stanford, ISBN: 978-9814364638, 2013.
2. Asoke K Talukder, HasanHasan Ahmed and Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd Edition, Tata McGraw-Hill Education Private Limited, ISBN: 978-0070707313, 2011.

OUTCOMES :

Students who complete this course will be able to

- Acquire capability to work with heterogeneous networks.
- Apply the knowledge of various mobile operating systems like Android to develop mobile computing applications.
- Develop mobile computing applications by analyzing their requirements.
- Identify the security algorithms to be used for mobile computing environment.
- Analyze business practices in mobile computing applications and their technical feasibility.
- Comparatively evaluate deployment platforms for mobile computing applications.

CSCY110 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES :

To describe digital image processing with respect to computer vision.
To analyze digital images through programming tools.
To theorize the background of image processing techniques.
To gain knowledge on filters, edges and contours.
To program with Image J software.
To implement image processing techniques using java.

MODULE I IMAGE ANALYSIS 09

Digital image processing – Image formation and Sensing -Image representation-Digital image analysis-Segmentation-Line detection – Feature analysis and Pattern classification.

MODULE IIPROGRAMMING WITH TOOLS 09

CVIP Software – Image data and file structures- Algorithm test and analysis tool-Application development- CVIP Feature Extraction and pattern classification tool.

MODULE III IMAGING SOFTWARE 09

Digital images - Programming with images-Types of digital images -Image acquisition- Image file formats - ImageJ software - Image J Overview.

MODULE IV FILTERS, EDGES AND CONTOURS 09

Linear filters-Non linear filters-Implementing filters-Gradient based edge detector-Simple edge detector-Canny Edge detector -Edge sharpening.

MODULE VPROGRAMMING IMAGEJ SOFTWARE 09

Point operations in ImageJ-Filter operations in Image J-Edge operations in Image J-Java implementation of Hough transform, filters- Advanced programming.

Theory 45

REFERENCES :

1. Scott E Umbaugh, “Digital Image Processing and Analysis: Human and

Computer Vision Applications with CVIP tools", CRC Press, 2nd Edition, ISBN 1439802068, 2016.

2. Wilhelm Burger and Mark. J. Burge, "Digital image processing: An Algorithmic introduction using Java", 2nd Edition, Springer, ISBN: 978-1-4471-6683-2, 2016.

OUTCOMES :

Students who complete this course will be able to

- Describe various digital image formats.
- Write program through tools for analyzing images.
- Use of point and regional processing techniques.
- Apply filters in digital image processing.
- Illustrate the concepts of edges and contours.
- Implement image processing methodologies using the environment image software and java.

CSCY111 BIO INSPIRED ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To showcase the various Bio Inspired Models for Semantic Web.
- To comprehend the Evolutionary Learning and its Applications.
- To illustrate the concept of Evolutionary Algorithms.
- To explicate the Developmental and Artificial Immune Systems.
- To expose to Collective Systems such as Particle Swarm Optimization (PSO),Ant Colony Optimization (ACO) and Swarm Robotics.
- To explicate the Optimization Algorithms with application.

MODULE I BIO INSPIRED MODELS 09

Introduction - Semantic Web - Constituent Models - Artificial Neural Networks- Swarm Intelligence - Applications of Semantic Web - Neuro-Fuzzy systems for the Web Content Filtering – Applications.

MODULE IIEVOLUTIONARY LEARNING 09

Hybrid Neural Systems – Genetic Algorithms - Introduction to Fuzzy Concepts – Fuzzy Inference Systems – Neural Fuzzy Approach – Hybrid Neural Network – Genetic Algorithm Approach - Applications.

MODULE III EVOLUTIONARY ALGORITHMS 09

Particle swarm optimization (PSO)– Ant Colony Optimization (ACO)–Swarm Robotics – Lion Optimization Algorithm - Ant Lion Optimization-Cockroach Swarm Optimization – Comparison of Firefly and Cockroach - Cuckoo Search - BColony Optimization - Bees Algorithm.

MODULE IV IMMUNE ALGORITHMS 09

Overview-Clonal Selection Algorithm - Negative Selection Algorithm - Artificial Immune Recognition System - Immune Network Algorithm –Dendritic Cell Algorithm.

MODULE VDNA COMPUTING 09

Need for DNA Computing-Structure of DNA- Operations on DNA Molecules-Adleman‟s Experiment-Basics of Formal Language Theory.

Theory 45

REFERENCES :

1. Xin-She Yang, Zhihua Cui, Renbin Xiao, Amir Hossein Gandomi, Mehmet Karamanoglu,"Swarm Intelligence and Bio-Inspired Computation: Theory and Applications", First Edition ,Elsevier,ISBN:978-0-12-405163-8, 2013
2. Management Association, Information Resources, "Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications", IGI Global,ISBN:978-1-5225-0788-8, 2016
3. Jason Brownlee, "Clever Algorithms: Nature-inspired Programming Recipes", First Edition Lu Lu, ISBN:978-1-4467-8506-5, 2011.
4. Gheorghe Paun, Grzegorz Rozenberg, Arto Salomaa ,"DNA Computing: New Computing Paradigms",Springer, Second Edition,ISBN:978-3-642-08388-4,2005
5. Grady Hanrahan, "Artificial Neural Networks in Biological and Environmental Analysis", CRC Press,ISBN-3:978-1-4378-1259-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Apply the Bio Inspired Models in Semantic Web.
- Familiarize with the concepts of Fuzzy Networks and Genetic Algorithm with Applications.
- Design and Implement simple Bio-Inspired Algorithms.
- Acquire adequate knowledge in various Immune Algorithms.
- Get insight into biologically inspired as well as Traditional Machine Learning Methods for Search, Optimization and Classification.
- Acquire knowledge of using the Bio Inspired Models for Real World Applications.

CSCY112 SOFTWARE DESIGN AND ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES :

- Understand object-oriented analysis and design, modeling, design principles for object-oriented programming.
- Use Unified Modeling Language (UML) to document architectural design.
- Analyze and evaluate system architectures.
- Understand service-oriented architecture ,systems based on services, service-oriented architecture, and important web standards
- To use REST architecture and REST services for web application
- Apply design patterns to interactive applications
- To redesign an application to use design patterns.

MODULE I OBJECT ORIENTED ANALYSIS ,DESIGN AND MODELING 9

Object-oriented analysis and design-Design in the Software Process, Design for Quality Attributes, Class Responsibility Collaborator.**Object-Oriented Modeling**-Evolution of Programming Languages, Four Design Principles, Design Structure in Java and UML Class Diagrams.

MODULE II OBJECT ORIENTED DESIGN PRINCIPLES 9

Evaluating Design Complexity, Separation of Concerns, Information Hiding, Conceptual Integrity, Generalization Principles, Specialized UML class diagrams.

MODULE III DESIGN PATTERNS 8

Introduction to Design Patterns: Creational & Structural Patterns-Introduction to Design Patterns, Gang of Four's Pattern Catalogue-Singleton Pattern, Factory Method Pattern. Façade Pattern, Adapter Pattern, Composite Pattern, Proxy Pattern, Decorator Pattern. **Behavioral Design Patterns**-Template Method Pattern, Chain of Responsibility Pattern, State Pattern, Command Pattern.**Working with Design Patterns & Anti-patterns**-MVC Pattern, Design

Principles Underlying Design Patterns and Anti-Patterns & Code Smells.

MODULE IV SOFTWARE ARCHITECTURE 9

UML Architecture Diagrams-Architecture Overview and Process , Kruchten's 4+1 View Model ,Component Diagrams ,Package Diagrams ,Deployment Diagram , Activity Diagram.**Architectural Styles**-Language-Based Systems, Repository-Based Systems, Layered Systems, Interpreter-Based Systems, Dataflow Systems, Implicit Invocation Systems, Process Control Systems.**Architecture in Practice**-Quality Attributes, Analyzing and Evaluating an Architecture, Relationship to Organizational Structure, Product Lines and Product Families.

MODULE V SERVICE ORIETNED ARCHITETCURE 9

Web Technologies-Service-Oriented Architecture, Service Principles, History of Web-based Systems, and Distributed Systems Basics. Web Service-Introduction to Web Services, Service Invocation (SOAP) ,Service Description (WSDL) ,Service Publication and Discovery (UDDI), Service Composition (BPEL), REST Architecture for SOA-Introduction to REST, Designing a REST Service, Introduction to Micro services.

L – 45; Total Hours :45

REFERENCES :

1. Baier, C., &Katoen, J. P. (2007). *Principles of model checking*. Cambridge, MA; Massachusetts Institute of Technology.
2. Bell, D. (2004, February 16). UML basics: The sequence diagram. IBM: developer Works.
3. Gamma, E., Helm, R., Johnson, R., &Vlissides, J. (1994). *Design Patterns: Elements of Reusable Object-Oriented Software*. Upper Saddle River, NJ: Addison-Wesley Professional.
4. Fowler, M. (1999). *Refactoring: Improving the Design of Existing Code*. Reading, Massachusetts: Addison-Wesley.
5. McCormack, A., Rusnak, J., & Baldwin, C. (2007). *Exploring the duality between Product and organizational architectures: A test of the "mirroring" hypothesis*.

6. Van der Linden, F. J., Schmid, K., &Rommes, E. (2007). *Software product lines in action: The best industrial practice in product line engineering*.

7. Thomas Erl, Service-Oriented Architecture : Concepts, Technology, and Design (The Prentice Hall Service Technology Series 1st Edition.

8. Mark Richards, (2016) Microservices vs. Service-Oriented Architecture,O'Reilly Media, Inc. 1st Edition.

OUTCOMES :

Students who complete this course will be able to

- use object oriented programming language to implement object oriented concepts.
- design and develop different UML diagram for any application
- able to make flow of software project development
- select effective pattern for software project and apply different types of design pattern
- develop web services using technologies.
- build SOA based applications for intra enterprise and inter enterprise applications.

WIRELESS NETWORKS

CSCY113 **L T P C**

3 0 0 3

OBJECTIVES

- To study the various wireless technologies and various access technologies such as 3G, 4G
- To understand the architectures of Wireless LAN technology.
- To understand issues and various Wi-Fi protocols.
- To study the fundamentals and protocols of PAN
- To analyze the various 802.15 protocols
- To study and compare various wireless protocols

MODULE I WIRELESS SYSTEM & RANDOM ACCESS PROTOCOLS 9

Introduction - First and Second Generation Cellular Systems - Cellular Communications from 1G to 3G - Wireless 4G systems - The Wireless Spectrum - Random Access Methods: Pure ALOHA - Slotted ALOHA - Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD) - Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

MODULE II WIRELESS LANS 9

Introduction - Importance of Wireless LANs - WLAN Topologies - Transmission Techniques: Wired Networks - Wireless Networks - comparison of wired and Wireless LANs - WLAN Technologies: Infrared technology -UHF narrowband technology, Spread Spectrum technology.

MODULE III IEEE 802.11 STANDARD FOR WIRELESS LANS 9

Network Architecture - Physical layer - The Medium Access Control Layer; MAC Layer issues: Hidden Terminal Problem - Reliability - Collision avoidance - Congestion avoidance- Congestion control- Security - The IEEE 802.11e MAC protocol.

MODULE IV WIRELESS PANS 9

Introduction - Importance of Wireless PANs - The Bluetooth technology: Bluetooth Characteristics - the Bluetooth Architecture – Protocol stack – Core and Adapted Protocols - Bluetooth Usage Models - RFID Technology - RFID Definition - Historical Background - RFID vs. Barcodes - Fundamentals of RFID - RFID Tags - Passive Transponders - Passive RFID

Coupling - Active Transponder - Semi-passive Transponders - Middleware - RFID Enabled Applications

MODULE V IEEE 802.15 9

WiMAX: WiMAX Concept - WiMAX Protocol - WiMAX Architecture - IEEE 802.15.3 - The IEEE 802.15.4 - ZigBee Technology - ZigBee components and network topologies - The IEEE 802.15.4 LR-WPAN Device architecture: Physical Layer - Data Link Layer - The Network Layer - Applications; IEEE 802.15.3a Ultra wideband.

REFERENCES

1. Clint Smith, Daniel Collins, “Wireless Networks”,McGraw-Hill Education, 3 edition 2014.
2. Vijay K.Garg, “Wireless Communications and Networking”, Morgan Kaufmann Publishers, 2009.
3. KavehPahlaram, Prashant Krishnamurthy, “Wireless Networks”, PHI, 2002.
4. Marks Ciampor, JeorgeOlenewa, “Wireless Communication”, Cengage Learning, 2007.
5. Gordon Colbach, “Wireless Networking: Introduction to Bluetooth and WiFi”, 2018

OUTCOMES

Students who complete this course will be able to

- Describe latest wireless technologies and trends in the communication field.
- Acquire the knowledge on Network Architecture and Applications of Ad-hoc and Wireless Sensor Networks.
- Analyze the protocol design issues of Ad-hoc Networks.
- Recognize the importance of RFID Technology and application in real world.
- Familiarity with CSMA mobile standards. •
- Describe different types of networks – LANs, PANs, WANs, Gigabit networks,WLANs,WiMax etc.

ECCY009 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce emerging technological options and platforms
- To explain the architecture of IoT
- To explore application development for mobile Platforms
- To Provide the appropriate IoT solutions and recommendations according to the applications used.

MODULE I THE IOT NETWORKING CORE 10

History of IoT, Review of Technologies involved in IoT Development, Internet/Web and Networking Basics -OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing. Basics of Big Data, Data Science.

MODULE IIIOT ARCHITECTURE AND APPLICATIONS 09

Architecture: M2M – Machine to Machine, Web of Things, IoT protocol, Introduction to wireless and mobile networks, ZigBee, BLE mesh, WiFi, MQTT, LoRa-Machine Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

MODULE III IOT PLATFORM OVERVIEW 09

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment‟s – Router, Switches, Overview and working principle of Wireless Networking equipment‟s – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

MODULE IV IOT APPLICATION DEVELOPMENT 09

Application Protocols-MQTT, REST/HTTP, CoAP, MySQL -Back-end Application -Design Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS 10 25 47 /97 App Development tools

MODULE VCASE STUDY & ADVANCED IOT APPLICATIONS 08

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards

Theory 45

REFERENCES :

1. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann-2010.
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti , Arshdeep Bahga-2014.
3. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally-2013.
4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers -2013.
5. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 10. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.
6. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010.
7. Adelstein and S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing,” McGraw Hill, 2009.

OUTCOMES :

Students who complete this course will be able to

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art Internet of things
- Identify the architecture and infrastructure of IoT.
- Explain the core issues of IoT such as security, privacy, and interoperability
- Choose the appropriate technologies, algorithms, and approaches for the related issues.
- Identify problems, and explain, analyze, and evaluate various IoT solutions Attempt to generate new ideas and innovations in IoT.

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 – Bench marking – RTOS Micro Controller – RTOS availability – Tool chain availability – Other issues in selection processes.

MODULE IIEMBEDDED 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 VPOWER 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 Unified Hardware / Software Introduction‟, John &Wiley Publications, 2002.
4. Peter Barry, Patrick Crowley, “Modern Embedded Computing” Morgan Kaufmann 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

LIST OF EVEN SEMESTER ELECTIVES

CSCY201SOFTWARE TESTING AND QUALITY ASSURANCE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To elucidate the theoretical aspects of software testing.
- To demonstrate the testing design methods.
- To expose to various industrial practices on software testing and quality assurance strategies
- To explain the fundamental concepts of defect analysis
- To introduce the software quality metrics
- To develop into a software tester and quality controller

MODULE I FOUNDATIONS OF SOFTWARE TESTING 09

Software Testing Lifecycle - Software Quality Attributes - Software Specifications- Program Correctness and Verification- - Software Testing Taxonomy

MODULE IITEST DATA GENERATION 08

Testing Plan and Design -Test Generation Concepts - Functional Criteria-Structural Criteria- Failures, Errors, and Faults

MODULE III TEST DEPLOYMENT AND ANALYSIS 09

Test Oracle Design - Test Driver Design - Test Outcome Analysis - Metrics for Software Testing - Software Testing Tools - Test execution and reporting.

MODULE IV SOFTWARE QUALITY MANAGEMENT 10

Software Quality Concept-Defect Management- Risk Vulnerability and Threat Management- Software Quality Expectation- Software Quality Characteristics- Information Audit- Security Policy Document -Software Reliability and Process Improvement

MODULE V SOFTWARE QUALITY ENGINEERING APPLICATIONS 09

Software Quality Engineering- System and Software Quality Engineering Applications- Trustworthiness of IT Systems and Services- Case Studies

Theory 45

REFERENCES :

1. Ali Mili, FairouzTchier, “Software Testing: Concepts and Operations”, Jon Wiley & Sons Publications, ISBN: 978-1-118-66287-8,2015.
2. Abu SayedMahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit”, CRC Press, Taylor and Francis Group, Auerbach Publications, ISBN 978-1-498-73553-7, 2016.
3. WitoldSuryn, “Software Quality Engineering: A Practitioner's Approach”, IEEE Computer Society Press, Jon Wiley & Sons Publications, ISBN: 978-1-118-83018-5, 2014.

OUTCOMES :

Students who complete this course will be able to

- Comprehend the types of Software Testing plans.
- Compare the different Software Testing design for the given data.
- Apply the various software testing strategies in industrial practices.
- Explore and use an appropriate testing tool for real time case studies.
- Analyze software quality attributes and ensure quality in IT Systems.
- Design and implement software quality engineering applications and take up a career as a professional software tester.

CSCY202 MOBILE ADHOC NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide a broad overview of the state of wireless and mobile ad hoc networking.
- To discuss physical, networking and architectural issues of mobile ad hoc networks.
- To elaborate the functions of various routing protocols under unicast, multicast and transport layer protocols.
- To give a knowledge about issues in QoS, energy management of mobile ad hoc networks
- To learn the various security mechanism used in mobile adhoc networks.
- To study the current technology trends for the implementation and deployment of mobile ad hoc networks.

MODULE I INTRODUCTION 09

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

MODULE IIROUTING PROTOCOLS 09

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

MODULE III MULTICASTING AND SECURITY PROTOCOLS 09

Introduction – Issues in designing a multicast routing protocol – Operation of multicast routing protocols –Classifications of multicast routing protocols – Tree-Based multicast routing protocols – Mesh-based multicast routing protocols. Security in Ad hoc wireless networks – Network security requirements – Issues

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

MODULE IV TRANSPORT LAYER PROTOCOLS 09

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

MODULE VQOS AND ENERGY MANAGEMENT 09

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

Theory 45

REFERENCES :

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and Protocols”, 2nd Edition, Pearson Education, ISBN-13: 9780133007060, 2012.
2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic “Mobile Ad Hoc Networking: The Cutting Edge Directions”, 2nd Edition, Wiley-IEEE Press, ISBN: 978-1-118-08728-2,2013.
3. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, “Mobile Ad Hoc Networks: Current Status and Future Trends” CRC Press, ISBN9781439856505 ,2012.

OUTCOMES :

- Students who complete this course will be able to
- Assess the platform architectures that are suitable for Mobile Adhoc networks.
- Identify the issues in wireless networks and how they can be addressed.
- Examine the various security threats to ad hoc networks and propose the solutions.
- Analyze the issues in designing the multicasting and security protocols for Mobile Adhoc networks.

- Analyze the challenges in designing the routing and transport protocols for Mobile Adhoc networks.
- Implement the various schemes to improve the quality of service in mobile Adhoc networks

CSCY203	PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the different metric for measuring the performance of the system.
- To familiarize with the importance of workloads and to predict the nature of future loads.
- To expose the students the importance of queuing theory.
- To design a petri net model for the given scenario.
- To describe the tools and techniques for test bed.
- To train the students on the basics of simulation modelling.

MODULE I INTRODUCTION 09

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

MODULE IIPROBABILITY AND STOCHASTIC PROCESSES 09

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

MODULE III QUEUING THEORY 09

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

MODULE IV PETRINETS AND SYSTEM PERFORMANCE 09

Petri nets - Classical Petri nets - Timed Petri nets - Priority-based Petri nets - Colored Petri nets - Generalized Petri nets - Tool selection - Validation of results - Performance metrics -Evaluation - Multiple server computer system analysis.

MODULE VANALYSIS AND SIMULATION 09

OS components - System architecture - Workloads - Design - Simulation - Analysis - Database system performance - Computer networks components - Simulation

modelling of LAN-Stochastic Simulations - Monte Carlo Simulation Random Number Generators .

Theory : 45

REFERENCES :

1. Jean-Yves Le Boudec, “Performance Evaluation of Computer and Communication Systems”, 1st Edition, EPFL press, Lausanne, Switzerland, ISBN 978-2-940222-40-7, 2010.
2. Paul J. Fortier and Howard E. Michael, “Computer Systems Performance Evaluation and Prediction", 1st Edition, Elsevier Science, USA, ISBN 1-55558-260-5, 2013.

OUTCOMES :

Students who complete this course will be able to

- Carry out the performance analysis of their computer systems.
- Categorize the different queuing models
- Identify the algorithm for analysis of networks.
- Design a test bed for a given scenario
- Suggest a simulator for a particular problem.
- Design simulation model for the real time problem.

CSCY204 ADVANCED DATABASES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To comprehend the different issues involved in the design and implementation of a database system
- To analyse the physical and logical database designs.
- To explore the database modelling, relational and object oriented models.
- To describe the techniques involved in the design of distributed databases.
- To recognize the various database techniques used in cloud and big data applications.

To develop an understanding of emerging DBMS for various applications

MODULE I ADVANCED SQL QUERIES AND DATABASE TUNING 08

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

MODULE IITHE EXTENDED ENTITY RELATIONSHIP MODEL AND OBJECT MODEL 09

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

MODULE III DISTRIBUTED DATABASES 10

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

MODULE IV INTRODUCTION TO CLOUD DATABASES AND BIG DATA 09

Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis. Batch computing models for Big Data computing- Key-value storage systems -- Scalable prediction models - Distributed file systems - Scalable data analytics-- Data models – Real time data stream analytics.

MODULE VEMERGING DATABASE MANAGEMENT SYSTEM TECHNOLOGIES **09**

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

Theory 45

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSCY205 REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To focus on the basic concepts and architecture of Real Time Systems (RTS).
- To provide an overview on memory management issues in real time operating systems.
- To explain the software requirement specification for RTS
- To discuss programming languages for Real Time Systems.
- To elaborate on the issues and challenges involved in RTS design and development.
- To throw a light on future visions of RTS.

MODULE I REAL TIME SYSTEMS 08

Fundamentals – Hardware – Basic Processor Architecture – Memory technologies – Architectural Advancements – Peripheral Interfacing – Microprocessor Vs Microcontrollers – Distributed Real Time Architectures.

MODULE IIREAL TIME OPERATING SYSTEMS 10

Pseudo kernels to operating systems – Theoretical Foundations of scheduling – system services for Application programs – Memory management issues – selecting Real Time Operating Systems – Coding of Real Time Software – Overview of programming languages for Real Time Systems – Automatic Code Generation – Compiler Optimizations of code.

MODULE III REQUIREMENTS ENGINEERING METHODOLOGIES 10

Requirements Engineering for Real Time Systems – Formal and Semi Formal Methods in System Specifications – Requirement Document – Case study in Software Requirements Specification

MODULE IVSOFTWARE DESIGN APPROACHES 10

Qualities of Real time systems – Software Engineering principles – Procedural Design Approach – Object Oriented Design Approach – Life Cycle Models – Case study in Designing Real Time Systems.

MODULE VPERFORMANCE ANALYSIS TECHNIQUES 07

Real Time Performance Analysis – Applications of Queuing Theory – Input/ Output Performance – Analysis of Memory Requirements – Future visions of on Real Time Systems.

Theory 45

REFERENCES :

1. Phillip A. Laplante and Seppo J. Ovaska, Real-Time Systems Design and Analysis: Tools for the Practitioner (Wse),ISBN: 978-8126541935, 2013.
2. Giorgio C. Buttazzo, “Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications”, 3rd Edition, Springer, ISBN: 978-1-4614-0675-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Analyze the various challenges associated with real time system and the techniques to manage them.
- Provide solutions for memory management issue in real time systems.
- Relate qualities of RTS for procedural design and object oriented design approach.
- Apply Formal and Semi Formal Methods in System Specifications.
- Compare and choose suitable software engineering approach for designing a Real Time System.
- Demonstrate Real Time Systems and its performance.

CSCY206 MULTICORE PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expose the basic concepts of multi-core and parallel programming.
- To study about performance of various parallel programming models.
- To elucidate the importance of parallel programming in shared memory architecture
- To elaborate on memory hierarchy organization in Multicore Architecture.
- To focus on challenges in parallel and multi-threaded programming.
- To have knowledge on various parallel programming paradigms and solutions.

MODULE I PARALLEL PROGRAMMING 08

Introduction - Parallel Computing – Parallel Hardware – Parallel Software – Input and Output – Performance – Parallel program design example – writing and running parallel programs.

MODULE IIMULTICORE ARCHITECTURE 10

Limits on Parallel Program Performance - Parallel Programming Models - Motivation for Memory Hierarchy - Basic Architectures of a Cache - Cache Performance - Prefetching - Cache Design in Multicore Architecture - Physical Cache Organization - Logical Cache Organization - Case Studies - Shared Memory Multiprocessors - The Cache Coherence Problem - Memory Consistency Problem - Synchronization Problem.

MODULE III DISTRIBUTED MEMORY PROGRAMMING WITH MPI 09

Compilation and execution - MPI programs - SPMD programs - Communication - Message matching - Trapezoidal Rule in MPI - Dealing with I/O – Collective Communication - Tree-structured communication - Collective Vs. Point-to-Point communications - MPI Derived Datatypes - Performance Evaluation of MPI Programs - Parallel Sorting Algorithm.

MODULE IV SHARED-MEMORY PROGRAMMING WITH PTHREADS 09

Starting, Running and Stopping the threads - Error checking - Matrix-Vector Multiplication - Critical Sections –Busy Waiting - Mutexes - Producer-Consumer Synchronization and Semaphores - Barriers and Condition Variables - Read-Write Locks - Caches, Cache Coherence, and False Sharing - Thread-Safety - Exercises - Programming Assignments.

MODULE V SHARED MEMORY PROGRAMMING WITH **OPENMP 09**

Compiling and running OpenMP programs - program and Error checking - The Trapezoidal Rule - Scope of Variables - The Reduction Clause -The parallel for Directive - More About Loops in OpenMP - Scheduling Loops -Producers and Consumers - Caches, Cache Coherence, and False Sharing - Thread-Safety - Exercises - Programming Assignments.

Theory 45

REFERENCES :

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/ Elsevier, ISBN 978-0-12-374260-5, 2011.
2. Yan Sohilin, Fundamentals of Parallel Multicore Architecture, Chapman and Hall/CRC Computational Science November 24, 2015, ISBN 9781482211184, 2015 (MODULE II)
3. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, ISBN-13: 978-0-321-71137-3, 2011.

OUTCOMES :

Students who complete this course will be able to

- Summarize the limitations in various parallel programming models.
- Compare and contrast programming for serial processors and parallel processors.
- Implement parallel programming system for Distributed Memory programming with MPI
- Implement parallel programming system for Shared Memory architecture using threads and open MP libraries.
- Analyze different problems in shared memory multiprocessors.
- Illustrate the design and performance issues in multicore architecture.

CSCY207 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide tools and techniques for project monitoring.
- To evaluate and assess the projects in Software Project Management.
- To find the cost of the project using cost benefit evaluation techniques
- To produce an activity plan for a project
- To identify the factors that influence people‟s behaviour in a project environment.
- To improve group working and to select appropriate leadership styles.

MODULE I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT09

Project Definition – Contract Management – Activities covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning

MODULE IIPROJECT EVALUATION 09

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

MODULE III ACTIVITY PLANNING 09

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

MODULE IV MONITORING AND CONTROL 09

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

MODULE VMANAGING PEOPLE AND ORGANIZING TEAMS 09

Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldham – Hackman Job Characteristics Model –

Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

Theory : 45

REFERENCES :

1. Bob Hughes, "Mike Cotterell, Rajib Mall, Software Project Management", 5th Edition, The McGraw-Hill Higher Education, ISBN :13:978-0-07-10724-8 , 2011.
2. Robert K. Wysocki, "Effective Project Management – Traditional, Agile, Extreme", 6th Edition, Wiley Publication, ISBN: 1118080653, 2011.
3. Robert K. Wysocki, "Effective Software Project Management", 3rd Edition, Wiley Publication, ISBN: 9780764596360, 2010.
4. MuraliChemuturi, Thomas M. Cagley , "Mastering Software Project Management: Best Practices, Tools and Techniques", J.Ross publishing, ISBN:9781604270341, 2010
5. 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

- Practice the process of project management and its application in delivering successful IT projects
- Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities
- Use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
- Identify the resources required for a project and to produce a work plan and resource Schedule
- Monitor the progress of a project and to assess the risk of slippage, revising targets or counteract drift
- Distinguish between the different types of project and follow the stages needed to negotiate an appropriate contract.

CSCY208 DEPENDABLE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expose the basic concept of dependable computing
- To explore the various error coding techniques used in dependable computing.
- To discuss the modelling tools used in dependable computing.
- To illustrate the countermeasure taken to deal with the impairment to dependability at the physical level.
- To showcase the importance of redundancy method to handle the fault.
- To discuss the issues at the architectural level when the subsystems interact.

MODULE I DEPENDABLE SYSTEMS 09

Dependable systems-Back ground and Motivation-Dependability attributes-combinational modelling –state space modelling.

MODULE IIPHYSICAL IMPERFECTIONS 09

Physical imperfections-Defect Avoidance-Defeat Circumvention-Shielding and Hardening –Yield Enhancement.

MODULE III LOGICAL DEVIATIONS 09

Logical Deviations-Fault Testing-Fault Masking –Design for Testability-Replication and Voting.

MODULE IV ERRORS 09

Information Distortions-Error Detection-Error Correction-Self Checking Modules-Redundant Disk Array

MODULE VMALFUNCTIONS 09

Architectural Anomalies-Malfunction Diagnosis-Malfunction Tolerance – Standby Redundancy-Resilient Algorithms.

Theory 45

REFERENCES :

1. Behrooz Parhami,”Dependable Computing, A Multilevel Approach”, TBD Publishers, 2015.

2. John Knight, “Fundamentals of Dependable Computing for Software Engineers”, ISBN 978143986255, 2012.

OUTCOMES :

Students who complete this course will be able to

- Identify the assessment component of dependability in computing systems.
- Suggest countermeasures to deal with impairments due to dependability at the physical level.
- Identify the logical level problem due to dependability and suggest solutions to solve them.
- Develop methods for detecting and correcting data path and control errors.
- Solve the technical problems that arise when the system interacts in a distributed system.
- Apply the redundancy algorithms for real time issues.

3 0 0 3

OBJECTIVES :

- To provide basics of computer graphics for advanced programming.
- To gain knowledge on motion and depth of graphics.
- To insight on features in advanced graphical effects.
- To focus on current, practical rendering methods used in games and otherapplications.
- To design program using Open GL tool box.
- To implement advanced animation through Open GL programming.

MODULE I MOTION AND DEPTH 09

Computer graphics –Display- Graphic file formats – Layering with depth - nimation – Camera and tilting - Illusion of depth- User interface.

MODULE IIADVANCED GRAPHICS 09

Particle systems- Creating effects – An Effect system – Optimization – GPU Programming – Pixel modification – Shader languages – Polish.

MODULE III 3D REAL TIME RENDERING 09

Graphics rendering pipeline – Transforms – Texturing – Advanced Shading – Global illumination – Non-photo realistic rendering - Graphics hardware.

MODULE IV 3D COMPUTER GRAPHICS PROGRAMMING 09

Open GL – Open GL Geometric primitives – Three Dimensions, Depth Buffer and Perspective projection – Drawing projects- Open GL tool box- Animation and Viewing.

MODULE VRENDERING PIPE LINE 09

Programming with Open GL - Advanced animation – Modeling in 3D space – Fixed functionality pipeline - Shaders and the programmable pipeline: Lift Off – Shaders and the programmable pipeline: Escape Velocity- Examples.

Total Hours 45

REFERENCES :

1. John Pile,Jr., " 2D Graphics Programming for Games" , CRC Press, ISBN 1466501901, 2016.

2. Tomas Akenine-Möller, Eric Haines, Naty Hoffman, "Real-Time Rendering", 3rd Edition, CRC Press, ISBN 1498785638, 2016.

3. Sumanta Guha," Computer Graphics Through OpenGL: From Theory to Experiments", 2nd Edition, CRC Press, ISBN 1498760597, 2015.

OUTCOMES :

Students who complete this course will be able to

- Explain the basics of computer graphics.
- Analyze the motion and depth of graphical design.
- Design advanced graphical effects and program it.
- Illustrate real time rendering methods for games and other applications.
- Use of the openGL Application Programming Interface (API) to code 3D scenes and animation, including games and movies
- Implement advanced animation and graphical effects for any application.

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 IITOOLS 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 VQUALITY 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, HasanHasan 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

CSCY211 WEB TECHNOLOGY

L	T	P	C
1	0	2	2

OBJECTIVES :

- To provide an overview about the web related essential elements.
- To expose the construction and manipulation of web databases.
- To depict the technologies in building the web.
- To explicate the various scripting languages.
- To be familiar with markup languages used in web.
- To practice the programming aspects in building a web.

MODULE I INTRODUCTION TO WEB TECHNOLOGIES 15

Web Technology Architecture - Markup Languages – Inter Process Communication- Scripting languages- Database Connectivity – Client Side and Server Side programming - Web Security.

MODULE IIDEVELOPING WEB APPLICATIONS 15

Client-Side Programming - Server-Side Programming - Creating Layout - Dynamic visuals to web application: building JSON Servlet and JQuery AJAX method - Integrating social website - Linking Dynamic Content from External Websites-Integrating E-commerce applications-Debugging and testing.

L-15; P-30

REFERENCES :

1. Achyut Godbole, Atul Kahate, “Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing”, Third edition, McGraw Hill Education Pvt Ltd, ISBN: 978-1-2-906268-1, 2013.
2. Jhon k, “Web technology: html, php, css, jquary, ajax, javascript”, Dreamtech press, 2014.
3. Sandeep Kumar Patel, “Developing Responsive Web Applications with AJAX and jQuery”, 1st edition, Packt publishing, ISBN: 978-1-78328-637-9, 2014.

OUTCOMES :

Students who complete this course will be able to

- Analyze a web page and identify its elements and attributes.
- Develop XML applications with DTD and style sheets for use with legacy browsers.
- Apply inter-process communication in web.
- Construct and manipulate web databases.
- Create a website and link it to social media.
- Build interactive web applications.

CSCY212 XML AND WEB SERVICES

L	T	P	C
1	0	2	2

OBJECTIVES :

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

MODULE I INTRODUCTION 15

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

MODULE IIBUILDING WEB SERVICES 15

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

L-15; P-30

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

- Create web based application with the suitable markup languages like XML or HTML
- Develop database driven web applications using various web designing tools.
- Build and consume web services.
- Develop web service enabled applications.
- Use SOAP, WSDL & UDDI.
- Construct, deploy and call web services using the existing web technologies.

CSCY213 MULTIMEDIA SYSTEMS

L	T	P	C
1	0	2	2

OBJECTIVES :

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

MODULE I MULTIMEDIA DESIGN 15

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

MODULE IIPROGRAMMING AND APPLICATIONS 15

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

L-15; P-30

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

- Construct mathematical transformations for multimedia signals.
- Analyse and process the multimedia signals such as images, audio, video.
  - Acquire the basic concepts of multimedia tools and process in design.
  - Illustrate design process of implementing multimedia systems.
  - Use static and time based media in Multimedia system.
  - Apply multimedia technology in various scenarios.

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 IICLOUD COMPUTING TECHNOLOGY 08

Virtualization-Types of virtualization-Virtualization and cloud computing- Client- thin, thick, mobile clients- Cloud Providers and Consumers-Various 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 VSECURITY IN CLOUD 08

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.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd.,2013
6. Tim Malhar, S.Kumaraswammy, 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

LIST OF SINGLE CREDIT ELECTIVE COURSES

CSCY071WIRELESS NETWORK PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

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

TOPICS

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

L – 8; P – 15

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSCY072 CLOUD COMPUTING PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

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

TOPICS

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

L – 8; P – 15

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSCY073 BIG DATA PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

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

TOPICS

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

L – 8; P – 15

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

CSCY074 VISUAL SYSTEMS PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

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

TOPICS

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

L – 8; P – 15

REFERENCES :

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

OUTCOMES :

Students who complete this course will be able to

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

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

CSCY075 OPEN SOURCE TOOLS

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To introduce to Open Source Ecosystem
- To create awareness on IPR issues, Licensing considerations
- To discuss concepts of Open Web and its role in Open Source Development
- To introduce varied open 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 e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

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

MODULE IIRISK 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 VPROJECT MANAGEMENT TECHNIQUES 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

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

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

GECY102	SOCIETY, TECHNOLGY & SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I TECHNOLOGY AND ITS IMPACTS 09

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

MODULE IITECHNOLOGY 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 VTHE IMPORTANCE OF SUSTAINABILITY 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

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

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I HISTORY AND FOUNDATIONS 08

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

MODULE IISEARCH 10

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

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

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

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

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

MODULE VCASE STUDY AND FUTURE APPLICATIONS 09

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

Total Hours: 45

TEXT BOOK:

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

OUTCOMES:

Students who complete this course will be able to

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

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 08

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

MODULE IICONSUMPTION 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 VSERVERS 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 IITHE 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 VBALANCED 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

M. Tech. | COMPUTER SCIENCE AND ENGINEERING | REGULATION 2016

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 IISOCIAL 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 VSOCIAL 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 IIARTIFICIAL 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 IISOFTWARE 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 VEMBEDDED 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 IICOMPONENTS 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 VSUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE **09**

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

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

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

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

OBJECTIVE:

To impart knowledge on

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

MODULE I OPERATIONS RESEARCH 09

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

MODULE IIPRODUCTION 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 VMANAGERIAL ECONOMICS 09

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

Total Hours: 45

REFERENCES:

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

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

OUTCOME:

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

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

GECY111	PROGRAMMING USING MATLAB & SIMULINK	L	T	P	C
		1	0	2	2

OBJECTIVES:

The aim of this course is to:

Teach students how to mathematically model engineering systems

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

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

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

Lab Experiments

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

MODULE IIROOT FINDING AND MATLAB PLOT FUNCTION 10

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

Lab Experiments

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

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

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

Lab Experiments

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

b. Euler method

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

MODULE IV INTRODUCTION OF SIMULINK 12

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

Lab Experiments

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

Total Hours (Including Practicals): 45

REFERENCE:

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

OUTCOMES:

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

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

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

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

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

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

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

MODULE IIMETHODS 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 IIEMBEDDED 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 IIPATENT 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