B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

# *Regulations 2019*
# *Curriculum and Syllabi*

(Amendments updated upto June 2020)

# M.Tech.
# (Computer Science & Engineering)

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

# REGULATIONS 2019

# CURRICULUM AND SYLLABI

**(Amendments updated upto June 2020)**

## M.TECH.

## COMPUTER SCIENCE AND ENGINEERING

## 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 multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

### MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- 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.

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

## VISION AND MISSION

### VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

### MISSION

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

## PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

### M. Tech. (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.

## PROGRAMME SPECIFIC OUTCOMES

**PSO1 :** Design, Analyze and develop essential proficiency in the areas related to algorithms, networking, web design, big data analytics, cloud computing, security, IoT and apply the knowledge to solve real world problems.

**PSO2 :** Apply the knowledge of computer science in various domains to identify research gaps and provide solutions in an optimized way.

# B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.

## REGULATIONS - 2019 FOR

## M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

***(Under Choice Based Credit System)***

## 1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires **"Programme"** means Post Graduate Degree Programme (M.Tech. / MCA / M.Sc.)

**"Course"** means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.,

**"Institution"** means B.S. Abdur Rahman Crescent Institute of Science & Technology.

**"Academic Council"** means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

**"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

**"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

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

## 2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

### 2.1 Programmes Offered

The various programmes and their mode of study are as follows:

| Degree | Mode of Study |
|---|---|
| M.Tech. | Full Time |
| MCA | |
| M.Sc. | |

## 2.2 ADMISSION REQUIREMENTS

**2.2.1** 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 clause 3.2 [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.

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

## 3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

**3.1**. The minimum and maximum period for completion of the Programmes are given below:

| Programme | Min. No. of Semesters | Max. No. of Semesters |
|---|---|---|
| M.Tech. | 4 | 8 |
| MCA (3 years) | 6 | 12 |
| MCA (Lateral Entry) | 4 | 8 |
| MCA (2 years) | 4 | 8 |
| M.Sc. | 4 | 8 |

**3.1.1** Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

**3.1.2** Medium of instruction, examinations and project report shall be in English.

## 3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

| Sl. No. | Name of the Department | Programmes offered | Qualifications for admission |
|---|---|---|---|
| 1. | Aeronautical Engineering | M. Tech. (Avionics) | B.E. / B. Tech. (Aeronautical Engineering) |
| 2. | Civil Engineering | M. Tech. (Structural Engineering) | B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) |

| | | | |
|---|---|---|---|
| | | M. Tech. (Construction Engineering and Project Management) | B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch. |
| 3. | Mechanical Engineering | M.Tech. (Manufacturing Engineering) | B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering) |
| | | M.Tech. (CAD/CAM) | |
| 4. | 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 and Drives) | |
| 5. | Electronics and Communication Engineering | M.Tech. (Communication Systems) | B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation) |
| | | M.Tech. (VLSI and Embedded Systems) | B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT) |
| 6. | Electronics and Instrumentation Engineering | M.Tech. (Electronics and Instrumentation Engineering) | B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE) |
| 7. | Computer Science and Engineering | M.Tech. (Computer Science and Engineering) | B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA) |
| 8. | Information Technology | M.Tech. (Information Technology) | B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA) |

| | | | |
|---|---|---|---|
| 9. | Computer Applications | MCA (3 years) | Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level |
| | | MCA – (Lateral Entry) | B.Sc. Computer Science / B.Sc. Information Technology / BCA |
| | | MCA (2 years) | Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA |
| 10. | Mathematics | M.Sc. (Actuarial Science) | Any Degree with Mathematics / Statistics as one of the subjects of study |
| 11. | Physics | M.Sc.(Physics) | B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation) |
| 12. | Chemistry | M.Sc.(Chemistry) | B.Sc. (Chemistry / Applied Science) |
| 13. | Life Sciences | M.Sc. Molecular Biology & Biochemistry | 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.Tech. Biotechnology | B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences |

### 3.3. STRUCTURE OF THE PROGRAMME

**3.3.1** The PG. programmes consist of the following components as prescribed in

the respective curriculum

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses ( NPTEL, SWAYAM, etc.,)

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

**3.3.3** For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

**3.3.4** The curriculum of 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 | Range of credits |
|---|---|
| M.Tech. | 74 - 80 |
| MCA (3 years) | 118 - 126 |
| MCA (Lateral Entry) | 80 - 85 |
| MCA (2 years) | 85 - 90 |
| M.Sc. | 77- 82 |

**3.3.5** Credits will be assigned to the courses for all programmes as given below:

- One credit for one lecture period per week or 15 periods of lecture per semester
- One credit for one tutorial period per week or 15 periods per semester
- One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- One credit for four weeks of industrial internship or 160 hours per semester.

**3.3.6** The number of credits the student shall enroll in a non-project semester and

project semester is as specified below to facilitate implementation of Choice Based Credit System.

| Programme | Non-project semester | Project semester |
|---|---|---|
| M.Tech. | 9 to 28 | 18 to 26 |
| MCA | 12 to 33 | 12 to 26 |
| M.Sc. | 9 to 32 | 10 to 26 |

**3.3.7** The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

**3.3.8** The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

**3.3.9** Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

**3.4. ONLINE COURSES**

**3.4.1** Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

**3.4.2** Students shall undergo project related online course on their own with the mentoring of the faculty member.

**3.5 PROJECT WORK / DISSERTATION**

**3.5.1** Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

**3.5.2** A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. 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 meetings for evaluating the progress.

**3.5.3** The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

**3.5.4** If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

## 4.0 CLASS ADVISOR AND FACULTY ADVISOR

### 4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD / Dean of School 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 / Dean of School of the students shall 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 in every semester.

## 5.0 CLASS COMMITTEE

**5.1** A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

**5.2** The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

**5.3** The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

**5.4** During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

**5.5** The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

## 6.0 COURSE COMMITTEE

**6.1** Each common theory / laboratory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling 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 handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

## 7.0 REGISTRATION AND ENROLLMENT

**7.1** The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

**7.2** For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

**7.3** A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

**7.4** A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

## 8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

**8.1** 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. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

## 9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / 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. | 18 |
| MCA (3 years) | 45 |
| MCA (Lateral Entry) | 22 |
| MCA (2 years) | 22 |
| M.Sc. | 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 ATTENDANCE**

**10.1** A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for 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. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

**10.2** The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

**10.3** A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year. However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

**10.4** A student shall register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be chosen with the approval of Head of the Department / Dean of School.

**11.0 REDO COURSES**

**11.1** A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule

and not exceeding prescribed maximum credits.

**11.2** The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

**11.3** The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

**12.0 ASSESSMENTS AND EXAMINATIONS**

**12.1** Every theory course shall have a total of three assessments during a semester as given below:

| Assessments | Weightage of Marks |
|---|---|
| Continuous Assessment 1 | 25% |
| Continuous Assessment 2 | 25% |
| Semester End Examination | 50% |

**12.2** Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

**12.3** For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

**12.4** The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

**12.5** In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

**12.6** In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

**12.7** For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

**13.0 SUBSTITUTE EXAMINATIONS**

**13.1** A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc.

by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

**13.2** A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

**14.0 SUPPLEMENTARY EXAMINATION**

**14.1** Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

**15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET**

**15.1** All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

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

**"W"** denotes withdrawal from the course.

**"I"** denotes inadequate attendance and hence prevented from appearing for semester end examination

**"U"** denotes unsuccessful performance in the course.

**"AB"** denotes absence for the semester end examination.

**15.2** A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

**15.3** The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department / Dean of School and it shall be declared by the Controller of Examinations.

**15.4** Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

**15.5** After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If $C_i$, is the number of credits assigned for the $i^{th}$ course and $GP_i$ is the Grade Point in the $i^{th}$ course

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

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

**“I” and "W"** grades are excluded for calculating GPA.

**"U", “I”, "AB"** and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

**15.6** After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

| Classification | CGPA |
|---|---|
| First Class with Distinction | 8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period. |
| First Class | 6.50 and above and completing the programme within a minimum prescribed period plus two semesters. |
| Second Class | Others |

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 period of study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the 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 is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall 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.

## 16.0 DISCIPLINE

**16.1** Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends

to affect the reputation of the Institution.

**16.2** Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

## 17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

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

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
ii. No disciplinary action is pending against him/her.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

**17.2** The award of the degree must have been approved by the Institute.

## 18.0 POWER TO MODIFY

Not withstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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# B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

## M.TECH. COMPUTER SCIENCE AND ENGINEERING CURRICULUM & SYLLABUS, REGULATIONS 2019

### SEMESTER I

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | MAD 6181 | Applied Algebra and Discrete Algorithms | 3 | 1 | 0 | 4 |
| 2. | CSD 6101 | Advanced Computer Architecture | 3 | 0 | 0 | 3 |
| 3. | CSD 6102 | Algorithm Design and Implementation | 3 | 0 | 2 | 4 |
| 4. | CSD 6103 | Computer Networks and Management | 3 | 0 | 0 | 3 |
| 5. | CSD 6104 | Advanced Software Engineering | 2 | 0 | 0 | 2 |
| 6. | | Professional Elective – 1 | 3 | 0 | 0 | 3 |
| 7. | CSD 6105 | Case Study 1 | 0 | 0 | 2 | 1 |
| | | | | | | **20** |

### SEMESTER II

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | GED 6201 | Research Methodology For Engineers | 3 | 1 | 0 | 4 |
| 2. | CSD 6201 | Machine Learning Techniques | 3 | 0 | 2 | 4 |
| 3. | CSD 6202 | Applied Cryptography & Network Security | 3 | 0 | 0 | 3 |
| 4. | | Professional Electives# | | | | 9 |
| 5. | | Value Added Course | | | | -- |
| | | | | | | **20** |

**SEMESTER III**

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSD 7101 | Internship | 0 | 0 | 2 | 1 |
| 2. | | Professional Electives -2 | | | | 6 |
| 3. | | General Elective | 3 | 0 | 0 | 3 |
| 4. | CSD 7102 | Project – Phase I | 0 | 0 | 12 | 6 |
| 5. | | MOOC Course | | | | -- |
| | | | | | | **16** |

**SEMESTER IV**

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSD 7102 | Project – Phase II | 0 | 0 | 36 | 18 |
| | | | | | | 6 + 18 = 24 |
| | | | | | | **Total Credits: 74** |

**Note:**

- Departments can have fixed core courses in each semester or giving choice of students to select satisfying prerequisite condition.(Optional)
- Enrollment in Value added course is mandatory for Programmecompletion.
- Enrollment in MOOC course (noncredit) is mandatory for Phase I Project completion and Project supervisor will act as course coordinator.
- For professional electives students can choose MOOC courses for credit transfer.

**Value Added Course: Guidelines**

- Any relevant certification course offered by theInstitution.
- Any relevant certification course offered by other Institutions / Universities; Bombay IIT (ST); MOOC courses etc.

**MOOC courses: Guide lines**

A minimum of one credit MOOC course relevant to project work shall be selected.

**Important Note:**

The selection of Value added course and MOOC by students shall be endorsed by Head of the Department.

## PROGRAMME ELECTIVE

### Elective I

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSDY 001 | Cloud Computing and Technology | 3 | 0 | 0 | 3 |
| 2. | CSDY 002 | Cloud Storage and computing | 3 | 0 | 0 | 3 |
| 3. | CSDY 003 | Virtualization | 3 | 0 | 0 | 3 |
| 4. | CSDY 004 | Cloud architecture and computing | 3 | 0 | 0 | 3 |
| 5. | CSDY 005 | Pervasive Computing | 3 | 0 | 0 | 3 |
| 6. | CSDY 006 | Social Network Analysis & Mining | 3 | 0 | 0 | 3 |
| 7. | CSDY 007 | Security issues in Cloud Computing | 3 | 0 | 0 | 3 |

### Elective II

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSDY 008 | Data warehousing and data mining | 3 | 0 | 0 | 3 |
| 2. | CSDY 009 | Data Science with Python | 3 | 0 | 0 | 3 |
| 3. | CSDY 010 | Big data analytics and IoT | 3 | 0 | 0 | 3 |
| 4. | CSDY 011 | Predictive Analytics | 3 | 0 | 0 | 3 |
| 5. | CSDY 012 | IoT Architecture and Protocols | 3 | 0 | 0 | 3 |
| 6. | CSDY 013 | Statistics for Business Analytic | 3 | 0 | 0 | 3 |
| 7. | CSDY 014 | Data Analytics | 3 | 0 | 0 | 3 |

### Elective III

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSDY 015 | Software Testing and Quality Assurance | 3 | 0 | 0 | 3 |
| 2. | CSDY 016 | Software Project Management | 3 | 0 | 0 | 3 |
| 3. | CSDY 017 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 |
| 4. | CSDY 018 | Software Design and Architecture | 3 | 0 | 0 | 3 |
| 5. | CSDY 019 | Formal methods of software engineering | 3 | 0 | 0 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6. | CSDY 020 | Agile software development | 3 | 0 | 0 | 3 |
| 7. | CSDY 021 | Software Engineering Process, Tools and Methods | 3 | 0 | 0 | 3 |

**Elective IV**

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSDY 022 | Mobile Adhoc Networks | 3 | 0 | 0 | 3 |
| 2. | CSDY 023 | Hacking Techniques & Digital Forensics | 3 | 0 | 0 | 3 |
| 3. | CSDY 024 | Information Security | 3 | 0 | 0 | 3 |
| 4. | CSDY 025 | Mobile & Wireless Network security | 3 | 0 | 0 | 3 |
| 5. | CSDY 026 | Wireless Networks | 3 | 0 | 0 | 3 |
| 6. | CSDY 027 | Mobile Application Development | 3 | 0 | 0 | 3 |
| 7. | CSDY 028 | RFID and Microcontroller | 3 | 0 | 0 | 3 |

**Elective V**

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | CSDY 029 | Knowledge Engineering and Expert Systems | 3 | 0 | 0 | 3 |
| 2. | CSDY 030 | Agent based intelligent systems | 3 | 0 | 0 | 3 |
| 3. | CSDY 031 | Deep Learning techniques | 3 | 0 | 0 | 3 |
| 4. | CSDY 032 | Statistical Natural Language Processing | 3 | 0 | 0 | 3 |
| 5. | CSDY 033 | Robotics and Intelligent Systems | 3 | 0 | 0 | 3 |
| 6. | CSDY 034 | Intelligent Information Retrieval | 3 | 0 | 0 | 3 |
| 7. | CSDY 035 | Soft computing | 3 | 0 | 0 | 3 |

## GENERAL ELECTIVE

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1. | GECY 101 | Project Management | 3 | 0 | 0 | 3 |
| 2. | GECY 102 | Society, Technology & Sustainability | 3 | 0 | 0 | 3 |
| 3. | GECY 103 | Artificial Intelligence | 3 | 0 | 0 | 3 |
| 4. | GECY 104 | Green Computing | 3 | 0 | 0 | 3 |
| 5. | GECY 105 | Gaming Design | 3 | 0 | 0 | 3 |
| 6. | GECY 106 | Social Computing | 3 | 0 | 0 | 3 |
| 7. | GECY 107 | Soft Computing | 3 | 0 | 0 | 3 |
| 8. | GECY 108 | Embedded System Programming | 3 | 0 | 0 | 3 |
| 9. | GECY 109 | Principles of Sustainable Development | 3 | 0 | 0 | 3 |
| 10. | GECY 110 | Quantitative Techniques in Management | 3 | 0 | 0 | 3 |
| 11. | GECY 111 | Programming using MATLAB & SIMULINK | 1 | 0 | 2 | 2 |
| 12. | GECY 112 | JAVA Programming | 3 | 0 | 0 | 3 |
| 13. | GECY 113 | PYTHON Programming | 3 | 0 | 0 | 3 |
| 14. | GECY 114 | Intellectual Property Rights | 1 | 0 | 0 | 1 |

## SEMESTER I

| | | L | T | P | C |
|---|---|---|---|---|---|
| **MAD 6181** | **APPLIED ALGEBRA AND DISCRETE ALGORITHMS ( For M Tech CS and IT)** | **3** | **1** | **0** | **4** |

**OBJECTIVES:**

The aims of this course are 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 9+3**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

**MODULE II LOGIC 9+3**

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 9+3**

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 9+3**

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

**MODULE V CIPHERS 9+3**

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

**L – 45; T – 15; Total Hours –60**

**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, New york, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, Edition 3,1993.

**OUTCOMES:** At the end of the course students will be able to

- Authenticate the correctness of the a 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.

**CSD 6101 ADVANCED COMPUTER ARCHITECTURE**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**OBJECTIVES:**

The aims of this course are

- To understand the functional requirements and their role in the system design
- To acquire essential knowledge to measure or predict system performance
- 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 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

**PREREQUISITES :** Computer Architecture

**MODULE I FUNDAMENTALS OF COMPUTER DESIGN 9**

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

**MODULE II MEMORY HIERARCHY DESIGN 9**

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 9**

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

**MODULE IV DATA-LEVEL PARALLELISM 9**

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

**MODULE V THREAD LEVEL PARALLELISM 9**

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; Total Hours –60**

**REFERENCES:**


1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann / Elsevier, 6th Edition, 2017.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design – The Hardware / Software Interface, 5th Edition, Morgan Kaufmann, Elsevier, 2014.
3. B.Govindarajalu, “Computer Architecture and Organization”, Tata McGraw Hill Education Pvt. Ltd., 2010.
4. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Addison Wesley, 2nd Edition, 2004.
5. D.Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.


**OUTCOMES:**

At the end of the course students 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.

| CSD 6102 | 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 9**

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

**MODULE II GRAPH ALGORITHMS 9**

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 9**

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 9**

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-COMPLETENESSANDAPPROXIMATION ALGORITHMS 9**

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; Total Hours –75**

**REFERENCES:**


1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, ”Introduction to Algorithms”, 3rd Edition MIT Press, 978-0262033848,2009.
2. Robert Sedgewick, Kevin Wayne, “Algorithms”, 4th Edition, Addison Wesley, ISBN-13: 978-0321573513, 2011.
3. Alfred V Aho, John E Hopcrof,” The Design and Analysis of Computer Algorithms”,Pearon Education,4th Edition, ISBN:978813170205,2009.
4. 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.

| CSD 6103 | COMPUTER NETWORKS AND MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 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 protocol
- To describe the concept and architecture of network management
- To showcase the different network management protocols like SNMP and ARP, RARP concepts
- To identify various network tools to simulate the working of connection oriented and connectionless networks.

**PREREQUISITES :** Computer Networks

**MODULE I INTRODUCTION TO COMPUTER NETWORKS 9**

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

**MODULE II TRANSMISSION CONTROL PROTOCOL (TCP) AND SWITCHING AND QUEUING DELAY MODELS 9**

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 9**

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 9**

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

Basic Foundation standards, Models and languages - Organization and information Models - Communication and functional Models – SNMP V2 – SNPV3.

**MODULE V INTERNETWORKING 9**

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP) - Mobility and Mobile IP.

**L – 45; Total Hours –45**

**REFERENCES:**


- Simon Parkinson,AndrewCrawton and Richard Hill ,"Guide to Vulnerability Analsis of Computer Networks and Systems" ,Springer,2018.
- 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.
- Olivier Bonaventure, "Computer Networking: Principles, Protocols and Practice", Creative Commons Attribution, ISBN: 978-1-365-18583-0, 2011.
- Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI, ISBN-13: 978-0136085300, 2014.
- Olivier Bonaventure ,"Computer Networking: Principles, Protocols and Practice" , ISBN 1365185834, 9781365185830 ,2016.


**OUTCOMES:** Students who complete this course will be able to

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

**CSD 6104 ADVANCED SOFTWARE ENGINEERING**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**OBJECTIVES:**

- To expose students to social, legal and ethical issues for Software Engineers.
- To provide experience using an agile like process.
- To expose to requirements engineering and 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.

**PREREQUISITES :** Software Engineering

**MODULE I ADVANCED SOFTWARE ENGINEERING 10**

Agile Process Development- Software Reuse – Reuse Landscape – Application Framework Application System reuse – Component Based Software Engineering Components and Components models – CBSE Processes – Component composition – Distributed Software Management**.**

**MODULE II SERVICE ORIENTED SOFTWARE ENGINEERING 10**

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 III SOFTWARE TESTING, MAINTENANCE AND MANAGEMENT 10**

Test Strategies - Software Reengineering - Reverse Engineering – Forward Engineering – Project Management – Project Planning – Software Pricing – Plan Driven development – Project Scheduling – Agile planning – Estimation Techniques – COCOMO Testing Modeling – Quality Management – Configuration management.

**Total Hours –30**

**REFERENCES:**


- Ian Sommerville, Software engineering, Pearson education Limited, 10th edition, ISBN : 978-1-292-09613-1,2016.
- Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw- Hill International Edition, 8th edition,ISBN-13: 978-0-0780-2212-8, 2014.
- 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 and carry out Software Maintenance.
- Evaluate research articles and thus be aware of the research front in software development.

## SEMESTER II

| GED 6201 | RESEARCH METHODOLOGY FOR 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 communications of research finding and writing of research reports, papers and ethics in research.

**PREREQUISITES :** Basics knowledge of engineering, probability, statistics

**MODULE I RESEARCH PROBLEM FORMULATION 9**

Research - objectives - types, Research methods and methodology, Research process, solving engineering problems-Identification of research topic - Formulation of research problem, literature survey and review.

**MODULE II RESEARCH DESIGN 10**

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

**MODULE III USE OF STATISTICAL TOOLS IN RESEARCH 12**

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

**MODULE IV DATA COLLECTION, ANALYSIS AND INTERPRETATION OF DATA 10**

Sources of Data, Use of Internet in Research, Types of Data - Research Data Processing and analysis - Interpretation of results- Correlation with scientific facts - repeatability and reproducibility of results - Accuracy and precision –

limitations, Application of Computer in Research- Spreadsheet tool, Presentation tool-Basic principles of Statistical Computation.

**MODULE V OPTIMIZATION TECHNIQUES 10**

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

**MODULE VI THE RESEARCH REPORT 9**

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 - List of funding agencies - scope for research funding - Patenting, Intellectual Property Rights.

**L – 45; T – 15; Total Hours –60**

**TEXT BOOKS:**

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.

**REFERENCES:**

- Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
- Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.

**OUTCOMES:**

At the end of the course, the student should be able to:

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

**CSD 6201 MACHINE LEARNING TECHNIQUES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

**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 models.
- To acquire the knowledge of various classification techniques.
- To learn the various neural network algorithms.

**PREREQUISITES :** Data Mining

**MODULE I INTRODUCTION 8**

Introduction – Classic and Adaptive Machines – Types of Learning – Elements – Data Formats – Learnability – Statistical Learning Approaches .

**MODULE II FEATURE SELECTION AND CLASSIFICATION 10**

Feature Selection and Feature Engineering – Linear Regression – Logistic Regression – Naïve Bayes – Support Vector Machines – Decision Trees – Ensemble Learning.

**MODULE III CLUSTERING 9**

Clustering Basics – K-Means – DBSCAN – Spectral Clustering - Evaluation Methods – Hierarchical Clustering - Hierarchical Strategies – Agglomerative Clustering.

**MODULE IV RECOMMENDATION SYSTEM AND NLP 9**

Introduction to NLP – NLTK and Built-in Corpora – BoW Strategy – Topic Modeling – Latent Semantic Analysis –Probabilistic Latent Semantic Analysis – Latent Dirichlet Allocation - Sentiment Analysis in NLP – VADER Sentiment Analysis with NLTK.

**MODULE V DEEP LEARNING 9**

Introduction to Deep Learning –ANN – Deep Architectures - Fully Connected Layers – Convolutional Layers – Drop out Layers – Recurrent Neural Networks - Tensor Flow – Computing Gradients – Logistic Regression – Classification with Multilayer Perceptron – Creating Machine Learning Architectures.

**L – 45; P – 15; Total Hours –60**

**REFERENCES:**

1. Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt, ISBN:9781785889622, 2017.
2. EthemAlpaydin, “Introduction to Machine Learning”, 3rd Edition, MITPress, ISBN: 9780262028189, 2014.
3. Kevin Patrick Murphy, “Machine Learning: a Probabilistic Perspective”, 4th edition, MIT Press, ISBN:9780262018029, 2013.
4. Ian H. Witten, Eibe Frank, Mark A. Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, 3rd Edition, Morgan Kaufmann,2011.

**OUTCOMES :**

Students to 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 deep learning algorithms for an application and analyze the results.
- Apply the appropriate algorithms for Sentiment analysis and Recommendation Systems.

| CSD 6202 | APPLIED CRYPTOGRAPHY AND NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**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 9**

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 8**

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

**MODULE IV WIRELESS NETWORK SECURITY 8**

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

**MODULE V SECURITY IN EMERGING TECHNOLOGIES 9**

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

**Total Hours – 45**

**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.

| VALUE ADDED COURSE | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 0 | 0 |

**OBJECTIVES:**

- To expose the latest technology / tools used in the industry and enable the students acquire knowledge and skill set in the same.

**GENERAL GUIDELINES:**

- Students should undergo any relevant certification course offered by the institution or other institutions / universities / IIT / IISc etc. for a minimum of 40 hours.
- Selection and completion of value added course by the students shall be endorsed by Head of the Department.

**OUTCOMES:**

- Students should be exposed and gained knowledge in any one latest technology used in the industry

| MOOC COURSE | L | T | P | C |
|---|---|---|---|---|
| | 0 | 0 | 0 | 0 |

**OBJECTIVES:**

- To learn the basics principles and concepts of the topic in which a project work is undertaken by the student.

**GENERAL GUIDELINES:**

- Students shall identify a MOOC course related to his/her project topic in consultation with the project supervisor.
- Student shall register for a MOOC course with minimum two credit offered by any recognized organization during the project phase I.
- Selection and completion of MOOC course by the students shall be endorsed by Head of the Department.

**OUTCOMES:**

Students will be able to

- Familiarize the basic principles and concepts related to the topic of his/her project work.
- Utilize the knowledge gained in the field of study to perform literature review with ease.
- Formulate the experimental / analytical methodology required for the project work

## PROGRAMME ELECTIVE

| CSDY 001 | CLOUD COMPUTING AND 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.
- To illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon.

**MODULE I CLOUD COMPUTING BASICS 9**

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

**MODULE II CLOUD COMPUTING TECHNOLOGY 8**

Virtualization-Types of virtualization-Virtualization and cloud computing- Clientthin, 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. i7 and ARM Cortex-A8.

**MODULE IV PROGRAMMING MODEL 10**

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

**MODULE V SECURITY IN CLOUD 8**

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

**L – 45; Total Hours –45**

**REFERENCES:**


1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach“, McGraw-Hill,2010.
2. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd.,2013
3. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
4. RajkumarBuyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc Publications,2011
5. Tim Malhar, S.Kumaraswammy, ShahedLatif ,”Cloud Security & Privacy”, O"Reilly media , 2009.


**OUTCOMES :**

Students to complete this course 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.
- Work with online cloud services and collaborate with online documents and web based applications.
- Explain the core issues of cloud computing such as security, privacy and interoperability.

**CSDY 002 CLOUD STORAGE AND COMPUTING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand the terms and terminologies of predictive modeling.
- To have knowledge about the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To understand the emergence of cloud as the next generation computing paradigm.
- provide sufficient foundations to enable further study and research.
- To provide comprehensive and in-depth knowledge to students in Cloud Computing concepts.

**MODULE I CLOUD FUNDAMENTALS** **9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

**MODULE II CLOUD COMPUTING TECHNOLOGIES** **9**

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.

**MODULE III CLOUD ARCHITECTURE, SERVICES AND STORAGE** **9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

**MODULE IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD** **9**

.Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards

**MODULE V CLOUD TECHNOLOGIES AND ADVANCEMENTS** **9**

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine — Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation

**L – 45; Total Hours –45**

**REFERENCES:**


1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017.
3. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.


**OUTCOMES:**

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Learn the key and enabling technologies that help in the development of cloud.
- Develop the ability to use the architecture of compute and storage cloud, service and delivery models.
- Explain the core issues of cloud computing such as resource management and security.
- Able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

**CSDY 003** **VIRTUALIZATION**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the basic virtual concepts and graph partitioning.
- To study the dynamic load balancing based on live migration.
- To learn about live migration in cloud data center.
- To highlight the role of lightweight live migration
- To know the migration from physical to virtual machines.
- To design successful virtualization applications and services.

**PREREQUISITES :**

- Distributed Systems
- User Interface Design

**MODULE I LIVE VIRTUAL CONCEPTS** **9**

Live Migration – Issues with Migration – Research on Live Migration – Total Migration Time – Graph Partitioning: Learning Automata Partitioning –Live Virtual Machine Migration: Importance of Virtualization - Advantages of Live Migration over WAN - Benefits of Virtualization-Types of Virtual Machines.

**MODULE II DYNAMIC LOAD BALANCING BASED ON LIVE MIGRATION** **9**

Introduction to Cloud Computing -Classification of Load Balancing Techniques – Policy Engine – Load Balancing Algorithms – Resource Load Balancing –Load Balancers in Virtual Infrastructure Management – VMware Distributed Resource Scheduler.

**MODULE III LIVE MIGRATION IN CLOUD DATA CENTER** **9**

Data Center Traffic Characteristics – Traffic Engineering for data Centers – Energy Efficiency in Cloud Data Centers – Major Cause of Energy Waste – Power Measurement and Modeling in Cloud – Power Measurement Techniques – Power Saving Policies in Cloud.

**MODULE IV LIGHTWEIGHT LIVE MIGRATION** **9**

VM Checkpointing – Enhanced VM Live Migration – VM Checkpointing Mechanisms – Lightweight Live Migration for Solo VM – Lightweight

Checkpointing –Storage-Adaptive Live Migration – Checkpoints and Mobility – Manual and Seamless Mobility

**MODULE V CASE STUDY** **9**

Hybrid Live Migration – Reliable Hybrid Live Migration – Case Study: Kernel-based Virtual Machine – Xen – Secure Data Analysis in GIS – Green Computing.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Dac- Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, “Cloud Computing and Virtualization”,1st Edition, Scrivener Publishing,2018. ISBN: 978-1-119-48790-6.
2. Edouard Bugnion, Jason Neih, Dan Tsafrir, “Hardware and Software Support for Virtualization”,1st Edition,Morgan& Claypool publisher,2017. ISBN: 9781627056939.
3. Lee chao, "Virtualization and Private cloud with VMware cloud suite”,1stEdition, CRC Press,2017.ISBN: 9781498784320.

**OUTCOMES :**

Students to complete this course will be able to

- analyze the cloud computing setup with its live migration applications using different architectures.
- apply and design suitable load balancing techniques.
- use and examine different cloud computing services.
- describe the importance of lightweight virtualization along with their technologies.
- explain the core issues of cloud computing such as security, privacy, and interoperability.
- identify the problems, and explain, analyze, and evaluate various cloud computing solutions.

**CSDY 004 CLOUD ARCHITECTURE AND COMPUTING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To teach about the fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability; benefits, as well as current and future challenges;
- To List type of cloud services and Cite Application of Cloud strategies for SaaS, PaaS, IaaS, DBaaS and Xaas. Discuss functional implementation of each of the above-mentioned cloud delivery model
- To Recognize steps and processes used to perform an audit assessment of a cloud computing environment.
- To Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.
- To Compare and contrast the economic benefits delivered by various cloud models based on application requirements, economic constraints and business requirements.
- To Analyze the components of cloud computing showing how business agility in an organization can be created

**PREREQUISITES:** Computer Network

**MODULE I INTRODUCTION 9**

Recent trends in Computing- Evolution of cloud computing-Business driver for adopting cloud computing-Introduction to Cloud Computing (NIST Model)- Cloud service providers - Benefits of Cloud Computing-Cloud Computing Architecture - Cloud computing stack -Role of Networks in Cloud Computing-Service Models - Deployment Models.

**MODULE II CLOUD SERVICE MODELS 9**

Introduction to IaaS-Resource Virtualization: Server, Storage, Network-Data storage in cloud computing (storage as a service)-Platform as a Service (PaaS)-What is PaaS, Service Oriented Architecture (SOA)-Cloud Platform and Management-Software as a Service (PaaS) -Web services.

**MODULE III CLOUD SERVICE MANAGEMENT 9**

Service Level Agreements (SLAs)-Billing & Accounting-Comparing Scaling Hardware: Traditional vs. Cloud-Economics of scaling: Benefitting Enormously-

Managing Large Scale Data Processing.

**MODULE IV CLOUD SECURITY 9**

.Infrastructure Security-Network level security, Host level security, Application level security -Data privacy and security Issues, Jurisdictional issues raised by Data Location-Trust, Reputation, Risk-Authentication in cloud computing-Cloud contracting Model, Commercial and business considerations.

**MODULE V DESIGN OF EXPERIMENTS 9**

Analysis of Case Studies when deciding to adopt cloud computing architecture. How to decide if the cloud is right for your requirements. Cloud based service, applications and development platform deployment so as to improve the total cost of ownership (TCO).

**L – 45; Total Hours –45**

**REFERENCES:**

1. Barrie Sosinsky" Cloud Computing Bible ",1st Edition, Wiley-India, 2010ISBN-13: 978-0470903568
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski" Cloud Computing: Principles and Paradigms "first edition, Wiley, 2011
3. Nikos Antonopoulos, Lee Gillam "Cloud Computing: Principles, Systems and Applications" Springer, 2012.
4. Ronald L. Krutz, Russell Dean Vines"Cloud Security: A Comprehensive Guide to Secure Cloud Computing" Wiley-India, 2010

**OUTCOMES :**

Students to complete this course will be able to

- Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
- Compare the advantages and disadvantages of various cloud computing platforms.
- Classify security and privacy issues in cloud computing.
- Investigate the performance, scalability, and availability of the underlying cloud technologies and software.
- Design & develop backup strategies for cloud data based on features.
- Recognize the importance of protocols and standards in management for cloud services.

**CSDY005 PERVASIVE COMPUTING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the relationship, basic concepts and structures in pervasive computing.
- To study the emerging technologies in the context of wireless networks
- To learn about Human-Computer Interface and Mobile Transactions in pervasive computing environment.
- To highlight the role of sensor networks, wireless protocols in the design of pervasive applications.
- 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.

**PREREQUISITES :** Distributed Systems & User Interface Design

**MODULE I BASIC CONCEPTS AND STRUCTURE 9**

Relationship of Wireless Computing - Ubiquitous Computing - Internet Computing – Perspectives of pervasive computing – Challenges – Technology – Infrastructure and Devices – Middleware for Pervasive Computing Systems: Resource Management – User Tracking – Context Management – Service Management – Data Management – Security Management–Pervasive Computing Environments.

**MODULE II CONTEXT COLLECTION AND RESOURCE MANAGEMENT 9**

Context Collection and Wireless Sensor Networks – User Tracking – Context Reasoning: Evidence Theory – DSCR Model – Propagating Evidence in Sensors Layer and Object Layer – Recognizing User Activity – Evidence Selection Strategy – Performance – Resource Management in Pervasive Computing: Efficient Resource llocation – Transparent Task Migration .

**MODULE III HUMAN-COMPUTER INTERFACE AND MOBILE TRANSACTIONS 9**

Overview –HCI Service and Interaction Migration – Context-Driven HCI Service Selection – A web service-based HCI Migration Framework – Mobile Transaction Framework – Context-aware Pervasive Transaction model –Dynamic Transaction Management – Format Transaction Verification.

**MODULE IV LOCAL AND WIDE AREA TECHNOLOGIES 9**

Local area wireless networks: IEEE 802.11 technologies - Mobile IP- Infrared technologies. Bluetooth networks (OBEX Protocol) - Messaging Systems - Personal Area Networks - Network Management - Quality of Service - Wireless protocols - Establishing Wide area wireless networks: Concept and structure of ”cell”- Call establishment and maintenance.

**MODULE V PROTOCOLS 9**

Protocols: Networking protocols - Packet switched protocols - Routing Protocols for Sensor Networks - Data Centric Protocols - Hierarchical Protocols Location-based protocols - Multimedia Messaging Service (MMS) Protocols Wireless Application Protocol (WAP)- Applications: Mobile access to patient information in a hospital, sales support, retailing.

**L – 45; Total Hours –45**

**REFERENCES:**

1. MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, “ Pervasive Computing Concepts,Technologies and Applications”, 1st Edition, CRC Press, 2016.
2. CiprianDobre and FatosXhafa, “Pervasive Computing-Next Generation Platforms for Intelligent Data Collection”, 1st Edition, Elsevier Publication, 2016. ISBN: 978-0-12-803663-1.
3. Natalia Silvis-Cividjian,”Pervasive Computing: Engineering Smart Systems”, Springer Publishing, 2017. ISBN: 978-3-319-51655-4.

**OUTCOMES :**

Students to complete this course will be able to

- Differentiate pervasive computing from normal computing applications.
- Explain the structure and context collection of pervasive computing.
- Describe how the devices (sensors and RFIDs) operate in a pervasive computing environment.
- Analyze the performance of different sensor data management and routing algorithms for sensor networks.
- Apply the basic techniques, algorithms, protocols of different types of networks for designing pervasive computing system.
- Identify the performance of various data dissemination techniques for mobile real-time applications.

| CSDY 006 | SOCIAL NETWORK ANALYSIS AND MINING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To familiarize the basic concepts of social network analysis.
- To learn the various methods of social network analysis.
- To get the knowledge of sentimental analysis in social network.
- To study the sentimental analysis of twitter analytics using R tool.
- To have the knowledge on facebook analytics using python.
- To acquire essential knowledge on applications of social network analysis.

**PREREQUISITES :**

- Data mining
- Networks
- Python

**MODULE I INTRODUCTION TO SOCIAL NETWORK ANALYSIS 9**

Introduction to Social network Analysis – Social Network - History of Social network analysis – Sociogram – Sociometry – Matrices and Cliques – Data collection.

**MODULE II SOCIAL NETWORK ANALYSIS METHODS 9**

Descriptive methods of Social network analysis – Graphs and Matrix representation –Density – Centrality, Centralization and Prestige – Cliques – Structural Equivalence – Inferential Methods in Social network analysis.

**MODULE III SENTIMANTAL ANALYSIS 9**

Sentimental Analysis in Social Networks – Key concepts of sentimental analysis - Level of analysis – Semantic Aspects - Twitter analytics – Sentimental analysis using R.

**MODULE IV FACEBOOK ANALYTICS- PYTHON 9**

Facebook analytics – Parsing API outputs – Uncovering Brand Activity, Popularity and Emotions on Facebook.

**MODULE V APPLICATIONS AND FUTURE TRENDS** **9**

Social network analysis applications - Work and Organizations – Crime and Terrorism – Emotional and Physical health - Trends Mining on GitHubs.

**L – 45; Total Hours –45**

**REFERENCES:**


1. John Scott," Social Network Analysis",4th Edition, SAGE Publication,2017.
2. Reda Alhajj, Jon Rokne, "Encyclopedia of Social Network Analysis and Mining", 2nd Edition, Springer New York,2018.
3. Song Yang, Franziska B. Keller, Lu Zheng, "Social Network Analysis: Methods and Examples", 1st Edition, SAGE Publication, 2016.
4. Siddhartha Chatterjee, Michal Krystyanczuk, "Python Social Media Analytics", 1st Edition, Packt Publishing Ltd, 2017.
5. Raghav Bali, Dipanjan Sarkar, TusharSharm, "Learning Social Media Analytics with R", 1st Edition, Packt Publishing Ltd, 2017.
6. Federico Alberto Pozzi, ElisabettaFersini, Enza Messina, Bing Liu," Sentiment Analysis in Social Networks", Morgan Kaufmann Publication, 2016.


**OUTCOMES :**

Students to complete this course will be able to

- Describe the terminologies used in social network analysis.
- Apply the various methods of social network analysis.
- Analyze the sentimental concept of any social network.
- Test the sentimental analysis of twitter characters using R tool
- Analyze the Facebook network using python programming.
- Identify the various field of applications of social network analysis.

| CSDY 007 | SECURITY ISSUES IN CLOUD COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To expose fundamental concepts of cloud security.
- To analyse the different attacks of cloud computing.
- Introduce the importance of cloud storage services.
- Relate current trends of risk management in cloud computing.
- Recognize the requirements of cloud security and provide various solutions to vendors.
- Illustrate the advanced security of cloud computing and demonstrate their use.

**PREREQUISITES :**

- Cloud computing

**MODULE I INTRODUCTION 9**

An Overview of Computer Security – Vulnerabilities and attacks-Security Mechanisms – Data Security – Digital Signature – Virtualization Security.

**MODULE II CLOUD STORAGE SERVICES 9**

Cloud Data Protection Models – Enforcing Access Cloud Control Policy – Data Leakage in the Cloud – Privacy and Security in Multiclouds– Desired Security and Privacy Properties – Ensuring Security, Privacy and Reliability.

**MODULE III RISK ANALYSIS AND CLOUD INFRASTRUCTURE 9**

Risk and Trust Assessment Schemes – Managing Risk – Cloud Security Risk Management – Cloud Risk Mitigation Methods –Distributed Access Control – Cloud User Controls – Secure Cloud Architecture.

**MODULE IV CLOUD SECURITY REQUIREMENTS 9**

. Negotiating Cloud Security– Vendors – Legal Compliance Risk – Personal Data Protection Requirements – Integrity Assurance – Locking Down Cloud Servers – Third-Party Providers Integrity Secure Computing – Secure Cloud Architecture.

**MODULE V ADVANCED CLOUD COMPUTING SECURITY** **9**

Advanced Security Architectures– Side-Channel Attacks – Trusted Computing Technology – Trusted Cloud Security – Defenses on Cloud Traffic – Clouds Are Evil – Future Directions in Cloud Computing Security.

**L – 45; Total Hours –45**

**TEXT BOOKS:**

1. John vacca ”Cloud Computing Security: Foundations and Challenges”,CRC Press Publisher,1st Edition,ISBN: 978-1-4822-6094-6,1st Edition,2016.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, “Cloud Security and Privacy”, O’Reilly Media, Inc, ISBN: 978-0-596-80276-9, 1st edition,September 2009.
3. Russell Dean Vines Ronald L.,”Cloud Security: A Comprehensive Guide to Secure Cloud Computing”,Wiley India; 1st edition, January 1, 2010.

**OUTCOMES :**

Students to complete this course will be able to

- Identify and address the issues in cloud computing
- Analyze the solutions for vulnerabilities and attacks in cloud security
- Describe the platform architectures that are suitable for cloud security
- Brief upon cloud security requirements prevailing across the globe.
- Categorize the different risk management and responsibilities in securecloud
- Apply the concept of defenses on cloud security in real time applications

**CSDY 008 DATA WAREHOUSING AND DATA MINING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide students with basic knowledge of tools used for data mining.
- 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.

**PREREQUISITES :**

- Data Base Management Systems

**MODULE I INTRODUCTION 9**

Introduction to Data Mining – Need of Data Mining - Data Mining Applications – Data Mining Process - Data Mining Techniques – Data Mining and Machine Learning.

**MODULE II DATA MINING TOOLS 9**

Introduction to Data Mining Tools – Weka, R – Preparing Data Set – Working with Data Set – Data Preprocessing – Need for Data Preprocessing – Data Preprocessing Methods – Data Cleaning – Data Integration- Data Transformation – Data Reduction.

**MODULE III CLASSIFICATION AND CLUSTERING 9**

Introduction – Types of Classification- Input and Output Attributes – Guidelines – Size and Quality of Training data set – Decision Tree Classifier – Naïve Bayes Method – Metrics – Quality of Classifiers – Applications of Cluster Analysis – Desired Features of Clustering – Distance Metrics – Clustering Algorithms – Partitioning Clustering – Hierarchical Clustering Algorithms.

**MODULE IV ASSOCIATION MINING AND WEB MINING 9**

Introduction –- Association Rule Mining – Metrics – Apriori Algorithm – Web Content Mining – Web Usage Mining – Web Structure Mining – Working of Search Engines –Page Rank Algorithm – Precision and Recall.

**MODULE V DATA WAREHOUSE 9**

Data Warehouse – Data Marts – Data Warehouse Schema –Online Analytical Processing – Introduction to Big data and NoSQL

**L – 45; Total Hours –45**

**REFERENCES:**


1. Parteek Bhatia, “Data Mining and Data Warehousing Principles and Practical Techniques”, 1st Edittion, Cambridge University Press, 2019, ISBN: 9781108727747
2. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, 3 rd Edition, ISBN 978-0-12-381479- Morgan Kaufmann Publishers, Elsevier, 2012.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, ISBN: 1-892095-02-5, Pearson education,2006.


**OUTCOMES :**

Students to 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.

**CSDY 009 DATA SCIENCE WITH PYTHON**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide computational environments for data scientists using python.
- To includes the ndarray for efficient storage and manipulation of dense data arrays in python
- To features the dataframe for efficient storage and manipulation of labeled/columnar data in python
- To includes capabilities for a flexible range of data visualizations in Python.
- To make decisions using applied and practical machine learning techniques.
- To learn the efficient and clean Python implementations of the most important and established machine learning algorithms

**PREREQUISITES :** Cloud computing

**MODULE I IPYTHON: BEYOND NORMAL PYTHON** **7**

Shell Or Notebook - Ipython Shell - Ipython Magic Commands - Input And Output History - Ipython And Shell Commands – Shell Related Magic Commands - Errors And Debugging - Profiling And Timing Code.

**MODULE II INTRODUCTION TO NUMPY** **9**

Understanding Data Types - The Basics Of Numpy Arrays - Computation On Numpy Arrays -Universal Functions –Aggregations - Min, Max,computation On Arrays: Broadcasting - Comparisons, Masks, And Boolean Logic - Fancy Indexing - Sorting Arrays - Structured Data: Numpy’s Structured Arrays.

**MODULE III DATA MANIPULATION WITH PANDA** **9**

Installing And Using Pandas - Introducing Pandas Objects - Data Indexing And Selection - Operating On Data In Pandas - Handling Missing Data - Hierarchical Indexing - Combining Datasets: Concat And Append - Combining Datasets: Merge And Join - Aggregation And Grouping - Pivot Tables - Vectorized String Operations - Working With Time Series - High-Performance Pandas: Eval() And Query().

**MODULE IV VISUALIZATION WITH MATPLOTLIB** **11**

. General Matplotlib Tips - Two Interfaces For The Price Of One - Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density And Contour Plots - Histograms, Binnings, And Density - Customizing Plot Legends - Customizing Colorbars - Multiple Subplots - Text And Annotation - Customizing Ticks - Customizing Matplotlib: Configurations And Stylesheets - Three-Dimensional Plotting In Matplotlib - Geographic Data With Basemap - Visualization With Seaborn.

**MODULE V MACHINE LEARNING** **9**

Machine Learning - Introducing Scikit-Learn - Hyperparameters And Model Validation - Feature Engineering - Naive Bayes Classification - Linear Regression - Support Vector Machines -Manifold Learning - K-Means Clustering - Gaussian Mixture Models.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Jake VanderPlas, "Python Data Science Handbook”Jake. Published by O’Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol,Copyright © 2017, ISBN-13:978-1491912050.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369

**OUTCOMES :**

Students to complete this course will be able to

- Perform powerful libraries for Machine learning applications and other scientific computations
- Describe about numpy and deal with feature like linear algebra, fourier transforms and advanced random number capabilities.
- Implement the pandas help us with munging and preparing data and also it is great for operating on and maintaining structured data, manipulating, transforming, and cleaning data
- Apply the matplotlib will let you plot different kinds of graphs and visualizing different types of data
- Describe the concepts and model of machine learning.

**CSDY 010 BIG DATA ANALYTICS AND IOT**

| L | T | P | C |
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**OBJECTIVES:**

- To provide the students with different concepts and applications behind big data analytics.
- To expose big data computing technologies, machine learning techniques, and scaling up machine learning approaches.
- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- To expose the building blocks of Internet of Things and characteristics.
- To realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- To introduce the tools required to manage and analyze big data like Hadoop, Spark SQL,etc.

**PREREQUISITES :**

- Data Mining
- Database Management

**MODULE I DATA TO BIG DATA 9**

Data to Big Data – Analytics Techniques – Building Data Analyitcs a compilation – Building and Understanding – Why Data analytics – Data Analytics Process.

**MODULE II DATA ANALYTICS AND MACHINE LEARNING 9**

Basics of Machine Learning – Supervised and Unsupervised Algorithms – Applications and Examples – Data visualization

**MODULE III INTERNET OF THINGS 9**

Introduction – Concepts – Framework – Technology Infrastructure - Derived Qualities – Challenges – Factors – Architecture.

**MODULE IV COMPUTING IN IOT 9**

Cloud and Fog Computing – RFID – IoT Design and Prototyping – Security Mechanisms.

**MODULE V TOOLS AND APPLICATIONS 9**

Case Study - Hadoop – Spark, Spark SQL - Deep Dive in Apache spark – IoT and Applications.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Soraya Sedkaoui, “Data Analytics and Big Data”, First Edition, Wiley Publications, 2018. ISBN 978-1-78630-326-4 (Module I & II)
2. Rajat Mehta, “Big Data Analytics with Java”, Pact Publishing, First Edition, 2017. ISBN :978-1-78728-898-0.(Module II)
3. Qusay F. Hassan,”Internet of Things A to Z: Technologies and Applications”, Wiley Publications, Second Edition,2018. ISBN: 978-1-111-945674-2. Module (III & IV)
4. VenkatAnkam, “Big Data Analytics”, Pact Publishing, First Edition, 2016. ISBN: 978-1-78588-496-6
5. NilanjanDey, Aboul Ella Hassanien, Chintan Bhatt, Amira S. Ashour, Suresh Chandra Satapathy, “Internet of Things and Big Data Analytics Toward Next-Generation Intelligence”, First Edition, Springer, 2017.


**OUTCOMES :**

Students to complete this course will be able to

- Categorize and summarize Big Data and its importance.
- select and implement machine learning techniques and computing environment that are suitable for the applications under consideration
- Identify the technology and standards related to IoT.
- Integrate computer based systems to the physical world.
- Design Iot based prototypes using big Data.
- Familiarize with tools and techniques with Apache spark, with Hadoop platform.

**CSDY 011 PREDICTIVE ANALYTICS**

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**OBJECTIVES:**

- To understand the terms and terminologies of predictive modeling.
- To study the various predictive models, their merits, demerits and application.
- To get exposure to various analytical tools available for predictive modeling.
- Develop a deep understanding of the predictive analytics life cycle.
- To have knowledge on the various issues in predictive analysis.
- To provide sufficient foundations in predictive analysis to enable further study and research.

**MODULE I INTRODUCTION TO PREDICTIVE MODELING 9**

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

**MODULE II PREDICTIVE MODELING BASICS 9**

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

**MODULE III PREDICTIVE MODELS 8**

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

**MODULE IV PREDICTIVE ANALYTICS 9**

Predictive modeling and Analyisis - Regression Analyisis, Multicollinearity , Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

**MODULE V DATA ANALYTICS AND APPLICATIONS 9**

Real time case study with modeling and analysis.

**L – 45; Total Hours –45**

**REFERENCES :**


1. Alberto Cordoba, “Understanding the Predictive Analytics Lifecycle”, Wiley, 2014
2. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, AmbigaDhiraj, Wiely CIO Series, 2013
3. Deepti Gupta “ Applied Analytics through case studies using SAS and R:implementing predictive models and machine learning techniques”, 1st Edition, MIT press, 2015.
4. Conrad Carlberg, “Predictive Analytics: Microsoft Excel”, 1st Edition, Que Publishing, 2012.


**OUTCOMES :**

Students to complete this course will be able to

- Ability to apply specific statistical and regression analysis methods
- Design and analyze appropriate predictive models.
- Define the predictive models for different applications
- Learn the key and enabling technologies that help in the development predictive modeling
- Ability to apply predictive analytics to identify new trends and patterns
- Evaluate and choose the appropriate technologies, algorithms and approaches for implementation and use of different predictive modeling.

**CSDY 012 IOT ARCHITECTURE AND PROTOCOLS**

| L | T | P | C |
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**OBJECTIVES:**

- To assess the vision and introduction of IoT.
- To Understand IoT Market perspective.
- To Implement Data and Knowledge Management and
- To study and Understand of the Security frameworks and privacy.
- To classify Real World IoT Design Constraints, Industrial Automation in IoT.

**PREREQUISITES :** Computer Networks & Cloud Computing

**MODULE I INTRODUCTION 9**

IoT definitions - An Architectural Overview – IoT Data Management and Analytics – Communication Protocols - Open IoT Architecture for IoT/Cloud Convergence- Scheduling Process and IoT Service Life Cycle - Scheduling and Resource Management – Application – Security and Privacy.

**MODULE II IoT ENABLERS AND SOLUTIONS 9**

Introduction to Programming Framework for IoT – Background Views – Survey of Iot Programming Frameworks – Virtualization on Embedded Boards - Virtualization and Real Time – Virtual Machines and Micro Virtual Machines – IoT Architecture for selected use cases.

**MODULE III IoT DATA AND KNOWLEDGE MANAGEMENT 9**

Introduction to Stream Processing in IoT Fundamentals, State Arts and Future Directions – A Framework for Distributed Data Analysis for IoT – Case Study.

**MODULE IV IoT RELIABILITY, SECURITY AND PRIVACY 9**

IoT Security Overview – Security Frameworks – Privacy in IoT Networks – Characteristics and issues – IoT Governance – TinyTO Protocols.

**MODULE V IoT APPLICATIONS 9**

Applied IoT – Sensors - Gateway – Data Transmission – Internet of vehicle and application – Basics – Characteristics and challenges – Enabling Technologies – Applications – Case Study.

**Total Hours – 45**

**REFERENCES :**

1. Rajkumar Buyya and Amir Vahid Dastjerdi “IoT Principles and Paradigms”,Cloud Computing and Distributed Systems (CLOUDS) Laboratory Department of Computing and Information Systems The University of Melbourne, Australia Manjrasoft Pty Ltd, Australia., USA Copyright © 2016 Elsevier Inc. All rights reserved. ISBN: 978-0-12-805395-9.

2. David Hanes, Gonzalo Salguerio, Patrick Grossetete, Rob Barton, Jerome Henry,”IoT Fundamentals, Networking Technologies, Protocols, Use case for the internet of things publisher: Pearson Education (US), Cisco Press ISBN: 9781587144561, 1587144565,Edition: 2017.

3. BK Tripathy and J.Anuradha IoT Technology ,Applications,Challenges and Solutions Publisher: Taylor & Francis Ltd,ISBN: 9781138035003, 1138035009,CRC Press.
   2018.

**OUTCOMES :**

Students to complete this course will be able to

- Interpret the vision of IoT from a global context.
- Determine the Market perspective of IoT.
- Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
- Implement the security problems and solutions.
- Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints

**CSDY 013 STATISTICS FOR BUSINESS ANALYTICS**

| L | T | P | C |
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**OBJECTIVES:**

- To elucidate the theoretical aspects of Business Analytics Process.
- To expose to the importance of resource considerations to support Business Analytics
- To accumulate knowledge of aligning resources to support Business Analytics within an organization
- To demonstrate the necessary visualizing and exploring data
- To introduce data mining concepts.
- To develop the ability to design implement and validate the forecasting Models

**PREREQUISITES :**

- Big data Analytics
- Statistics

**MODULE I INTRODUCTION** **9**

Business Analytics Process–Relationship of BA Process and Organization Decision-Making Process – Importance of Business Analytics – Business Analytics Personnel-Business Analytics Data.

**MODULE II ORGANIZATION STRUCTURES AND DESCRIPTIVE ANALYTICS** **9**

Organization Structures Aligning Business Analytics– Management Issues – Descriptive Statistics– Sampling and Estimation- Probability Distributions- Descriptive Analytics Step in the BA Process.

**MODULE III PREDICTIVE ANALYTICS** **9**

Predictive Modeling– Logic-Driven Models- Data-Driven Models-Data Mining – Data Mining Methodologies– Predictive Analytics Analysis- Case Study.

**MODULE IV PRESCRIPTIVE ANALYTICS** **9**

Prescriptive Modeling– Nonlinear Optimization- Marketing/Planning Case Study-Prescriptive Analysis .

**MODULE V BUSINESS ANALYTICS CASE PROBLEM 9**

Descriptive Analytics Analysis– Developing the Forecasting Models– Selecting and Developing an Optimization Shipping Model– Business Performance Improvement– Statistical Testing- Duality and Sensitivity Analysis in Linear Programming- Simple Regression Model- Decision Theory.

**L – 45; Total Hours –45**

**REFERENCES :**


1. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson,“Essentials of Business Analytics”, Cenage Learning, 2nd Edition, ISBN-13: 978-1-305-62773-4, 2016.
2. Marc J. Schniederjans Dara G. Schniederjans Christopher M. Starkey, “Business Analytics Principles, Concepts, and Applications”, Pearson Education Inc, 2014, ISBN-13: 978-0-13-355218-8
3. Kush R Varshney, “Introduction to Business Analytics”, Business Analytics and Mathematical Sciences Department, IBM Thomas J Watson Research Center,IBM Corporation, 2012.


**OUTCOMES :**

Students to complete this course will be able to

- Comprehend and compare the differentconcepts of business analytics.
- design models to reflect alignment of resources to support business analytics within an organization
- Apply the various business analytics models.
- Analyze the different forms of data.
- Evaluate research articles and thus be aware of the research front in predictive analytics
- Explore and use an appropriate forecasting model for real time case studies..

| CSDY 014 | DATA ANALYTICS | L | T | P | C |
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**OBJECTIVES:**

- To familiarize the basic data analytic techniques.
- To provide descriptive statistics on various scales.
- To visualize and summarize the data.
- To find natural groups and frequent patterns in dataset.
- To explore the predictive tasks, classification and regression.
- To provide applications of data analytics on sensitive fields.

**PREREQUISITES :**

- Statistics
- Data mining

**MODULE I INTRODUCTION TO DATA 9**

Data – Small data – Big data – Big data architectures –Big data and data science – Data analytics – KDD Process – The CRISP – DM Methodology.

**MODULE II DESCRIPTIVE STATISTICS 9**

Scale types – Descriptive Uni-variate analysis – Descriptive Bi variate analysis – Descriptive multi variate analysis – Location and Dispersion multivariate statistics – Infographics and Word Clouds.

**MODULE III PREPROCESSING DATA AND CLUSTERING 9**

Data Quality – Missing values – Redundant data – Inconsistent data – Noisy data – Data transformation – Principal and Independent Component Analysis – Independent Component Analysis – Attribute selection – Filters – Wrappers – Embedded – Clustering - Distance measures – Clustering techniques – K-means

**MODULE IV PATTERN MINING AND PREDICTING THE UNKONWN 9**

Frequent pattern mining – Apriori join based method – FP Growth – Association rules – Simpson's Paradox – Types of pattern – Predicting the unknown - Regression – Classification – Predictive methods.

**MODULE V APPLICATIONS 9**

Applications for Text, Web and Social media – Military applications of data analytics – Data analytics in government: current practices and future opportunities.

**L – 45; Total Hours –45**

**REFERENCES:**


1. João Moreira, Andre Carvalho, Tomás Horvath, "A General Introduction to Data Analytics", 1st Edition, John Wiley & Sons, 2018.
2. Herbert Jones, "Data Analytics: An Essential Beginners Guide to Data Mining, Data Collection, Big Data Analytics for Business, and Business Intelligence Concepts",1st Edition, CreateSpace Independent Publishing Platform,2018.
3. Soraya Sedkaoui, "Data Analytics and Big Data",1st Edition, John Wiley & Sons, 2018.
4. Kevin Huggins, "Military Applications of Data Analytics*Data Analytics Applications*",1stEdition, CRC Press, 2018.
5. Gregory Richards, "Big Data and Analytics Applications in Government: Current Practices and Future Opportunities*Data Analytics Applications*", 1st Edition, CRC Press, 2017.


**OUTCOMES :**

Students to complete this course will be able to

- Acquire in depth knowledge on data and data analytics techniques.
- Analyze and apply descriptive statistics on various scales.
- Acquire skills on data quality and preprocessing and clustering techniques.
- Identify frequent pattern among the data sets.
- Predict the unknown data through classification or regression.
- Apply the data analytics in various field of applications.

| CSDY 015 | SOFTWARE TESTING AND QUALITY ASSURANCE | L | T | P | C |
|---|---|---|---|---|---|
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**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 for increasing the product quality
- To develop into a software tester and quality controller

**MODULE I FOUNDATIONS OF SOFTWARE TESTING 9**

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

**MODULE II TEST DATA GENERATION 8**

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

**MODULE III TEST DEPLOYMENT AND ANALYSIS 9**

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-Software Quality metrics methodology.

**MODULE V SOFTWARE QUALITY ENGINEERING APPLICATIONS 9**

Software Quality Engineering- Models for Quality Assessment-Risk Identification for quantifiable quality improvement.-System and Software Quality Engineering Applications- Trustworthiness of IT Systems and Services- Case Studies

**L – 45; Total Hours –45**

**REFERENCES:**

1. 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.
2. Ivan Mistrik, Richard M Soley, Nour Ali, John Grundy,BedirTekinerdogan “Software Quality Assurance: in Large Scale and Complex Software intensive”, 1st Edition, Elsevier Publication,ISBN :9780128023013,2016
3. Ali Mili, FairouzTchier,, “Software Testing: Concepts and Operations”, Jon Wiley & Sons Publications, ISBN: 978-1-118-66287-8,2015.
4. 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 to 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

**CSDY 016 SOFTWARE PROJECT MANAGEMENT L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To learn the basic concepts of software project management.
- To discuss various processes in software project management.
- To expose various tools and packages.
- To understand the nature of software development and software life cycle process models, agile project management and other agile practices
- To expose different project management life cycles.
- To provide tools and techniques for project monitoring.

**PREREQUISITES :**

- Software Engineering

**MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 9**

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

**MODULE II PROJECT MANAGEMENT PROCESS GROUPS 9**

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

**MODULE III TPM PROJECT 9**

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

**MODULE IV COMPLEX PROJECT MANAGEMENT 9**

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

**MODULE V BUILDING AN EFFECTIVE PROJECT MANAGEMENT** **9**

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 7th Edition, Wiley Publication, 2014.
2. Günther Ruhe, Claes Wohlin, “Software Project Management in a Changing World, SpringerVerlag, 2014
3. Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management “, 5th edition, Tata McGraw-Hill Education Pvt. 2011
4. Roger S. Pressman, “Software Engineering” 8th edition, Mc Graw Hill Education, 2018

**OUTCOMES :**

Students to complete this course will be able to

- Explain the software project management concepts.
- Acquire the ability to track project execution.
- Estimate the cost and prepare project plan document.
- Design a project management plan using different project management life cycles.
- Lead a team and manage the people.
- Generate project schedule and can construct, design and develop different type of Projects

| CSDY 017 | OBJECT ORIENTED ANALYSIS AND DESIGN | L | T | P | C |
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**OBJECTIVES:**

- To enable the student to understand the concept of Object Oriented Analysis and Design.
- To understand the design concepts.
- To design traditional components.
- To expose the relations between interaction design and users expectations.
- To develop responsive web applications.
- To acquire knowledge in mob applications.

**PREREQUISITES :**

- Object Oriented Programming
- Software Engineering

**MODULE I UNIFIED PROCESS AND USE CASE DIAGRAMS 9**

Introduction to OOAD with OO Basics – Unified Process – UML diagrams – Use Case- Class Diagram - Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition – Relationship between sequence diagrams and use cases.

**MODULE II DESIGN CONCEPTS 9**

Design within the Context of Software Engineering - The Design Process- Design Concepts - The Design Model - Architectural Design - Software Architecture - Architectural Genres - Architectural Styles -Architectural Considerations - Architectural Decisions - Architectural Design – Assessing - Pattern-based Architecture Review - Architecture Conformance Checking - Agility and Architecture.

**MODULE III COMPONENT- LEVEL DESIGN 9**

Component-Level Design - Designing Class-Based Components - Conducting Component-Level Design - Component-Level Design for WebApps - Component-Level Design for Mobile Apps - Designing Traditional Components - Component-Based Development.

**MODULE IV USER INTERFACE DESIGN 9**

The Golden Rules - Place the User in Control - User Interface Analysis and Design

-Interface Analysis - Interface Design Steps - WebApp and Mobile Interface Design -Design Evaluation.

**MODULE V WEB APP DESIGN AND MOBILE APP DESIGN 9**

WebApp Design -WebApp Design Quality - Design Goals - A Design Pyramid for WebApps - WebApp Interface Design - Aesthetic Design - Content Design - Architecture Design - Navigation Design - Component-Level Design. MobileApp Design - The Challenges - Developing MobileApps - MobileApp Design - Mobility Environments - The Applicability of Conventional Software Engineering

**L – 45; Total Hours –45**

**REFERENCES:**

1. Roger S. Pressman, “Software Engineering” 8th edition, Mc Graw Hill Education, 2018
2. Simon Bennett, Steve Mc Robb and Ray Farmer, “Object Oriented Systems Analysis and Design Using UML”, Fourth Edition, Mc-Graw Hill Education, 2010.
3. Ali Bahrami – Object Oriented Systems Development – McGraw Hill International Edition – 2012
4. Craig Larman, “Appling UML and Patterns: An introduction to Object”, Oriented Analysis and Design and Unified Process, 3rd Edition, Pearson Education, 2007.

**OUTCOMES :**

Students to complete this course will be able to

- Use the UML analysis and design diagrams
- Design and implement projects using OO concepts.
- Design the component level design for mob apps.
- Implement basic user interface prototypes based on the design process
- Create dynamic web applications
- Implement and deploy mobile applications using an appropriate software development environment.

| CSDY 018 | SOFTWARE DESIGN AND ARCHITECTURE | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES:**

- To provide familiarity with the notion of software architectures, their importance, and different types of architectures.
- To understand the tools and techniques for the automatic analysis and evaluation of software.
- To introduce various software design techniques.
- To acquire knowledge on the various Architectural styles and patterns.
- To get exposed to all elements of architectural design and implementation of software systems
- To gain knowledge on the challenges of advanced software design and various issues relating to software design.

**PREREQUISITES :**

- Software Engineering

**MODULE I INTRODUCTION 9**

Motivation - Software Architecture –importance of Software architecture- Life-Cycle Activities-Role of Architect- Architectural Design-Architectural Drivers-Design concepts Many contexts of software Architecture.

**MODULE II QUALITY ATTRIBUTES 9**

Understanding Quality attributes- Availability-Interoperability-Modifiability-Performance -Security-Testability-Usability-Other Quality attributes-Architectural Tactics.

**MODULE III ARCHITECTURE IN THE LIFE CYCLE 9**

Architecture in Agile Projects—Requirements gathering - Designing an Architecture-Attribute Driven Design method-Steps of ADD- Documenting Software Architecture – Notations-Views and Architectural Styles-Implementation and Testing.

**MODULE IV ARCHITECTURAL PATTERNS 9**

Introduction; from mud to structure: Layers, Pipes and Filters, Blackboard. Distributed Systems: Broker; Interactive Systems: MVC, Presentation-Abstraction-Control

**MODULE V DESIGN PATTERNS 9**

Introduction to Design patterns- Creational and Structural Patterns – Behavioral Design Patterns - Working with Design Patterns & Anti-patterns

**L – 45; Total Hours –45**

**REFERENCES:**

1. Humberto Cervantes, Rick Kazman,"Designing Software Architectures: A Practical Approach" Addison-Wesley Professional, 2016
2. Len Bass,Paul Clements, Rick Kazman, "Software Architecture in Practice, 3rd Edition, Addison-Wesley, 2012
3. Mary Shaw and David Garlan,"Software Architecture- Perspectives on an Emerging Discipline", Prentice-Hall of India, 2007.

**OUTCOMES :**

Students to complete this course will be able to

- Describe the essential elements of software architecture;
- Analyze the different software architectural styles and methods of documenting architecture.
- Evaluate the quality attributes of software design and architecture.
- Explore the different considerations for designing software architecture.
- Apply fundamental design principles, methods, patterns and strategies in the creation of a software system and its supporting documents.
- Select and use appropriate software design patterns.

**CSDY 019 FORMAL METHODS IN SOFTWARE ENGINEERING**

| L | T | P | C |
|---|---|---|---|
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**OBJECTIVES:**

- To know and Understand the software life cycle models.
- To understand the generic techniques for analysis of software source code.
- To introduce suitable mathematical foundations: relational calculus and linear algebra of programming.
- To know and apply about as an individual and as part of a multidisciplinary team to develop and deliver architectural quality and modeling.
- To abstract the details of a software component in order to obtain a model suitable for formal verification.

**PREREQUISITES :** Software Engineering

**MODULE I INTRODUCTION** **9**

Software Engineering-Software Process- Generic process model - Prescriptive process model - specialized, unified process - Agile development-Agile Process - Extreme Programming- Other agile Process models - Software engineering Knowledge - core Principles - Principles that guide each framework Activity.

**MODULE II SOFTWARE ANALYSIS AND TESTING** **9**

Source Code Analysis: Scannerless and Generalised Parsing techniques - Parser Combinators - Generic Tree Traversals, Strategic Programming, Type Analysis, Data Flow Analysis, Inter-procedural Analysis, and flow control analysis. Software Quality - Source code metrics, software system metrics, empirical studies for software quality assessment, software quality models (CMMI, ISO 9126). Software Testing - Unit and functional testing; analysis of test coverage; model based testing; automatic generation of test cases.

**MODULE III SPECIFICATION AND MODELING** **9**

Introduction: the role of formal methods in software engineering - the role of abstraction in formal modeling - propositional and first-order logic. Relational logic - syntax and semantics - modeling using relations - introduction to the relational calculus; taxonomy and relational algebra. Alloy - specification of invariants and operations using pre- and post-conditions using relational logic; idioms for modeling dynamic behaviour; semantics and type system; automatic verification

techniques - comparison with other modeling languages. Specification of reactive systems - temporal logic (LTL and CTL); explicit state model checking; symbolic model checking; tools for model checking.

**MODULE IV ARCHITECTURE AND CALCULATION** **9**

Introduction to software architecture and reactive systems - problems, concepts and methods. Foundations - Transition systems as a basic architectural design structure. Simulation, bisimulation and invariants. Weighted automata and stochastic behaviour. Introduction to the linear algebra of programming. Paradigms of architectural design Process-oriented design. Introduction to AADL. Coordination-oriented design. Introduction to Reo. Architectural analysis Structural, behavioural and performance properties. Interactive Markov chains for architectural analysis.

**MODULE V FORMAL VERIFICATION** **9**

Theorem proving: introduction to the interactive construction of proofs. First order theories: employing SMT solvers. Deductive verification: program logics; verification condition generation; behavioral interface specification languages and design by contract. Tools covered: Dafny; Frama-C; SPARK. Model Checking: symbolic model checking - partial order reduction - bounded model checking. Tool covered: SMV. Software Model Checking - bounded model checking of software - existential abstraction mechanisms - predicate abstraction; abstraction refinement. Tools covered: CBMC; BLAST.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Roger S, “Software Engineering – A Practitioner’s Approach”, seventh edition, Pressman, 2010.
2. Generative Programming - Methods, Tools, and Applications, Krzysztof Czarnecki and UlrichW. Eisenecker,Addison-Wesley, June 2000
3. Daniel Jackson. Software abstractions: logic, language, and analysis. Revised edition, MIT Press, 2012.Christel Baier and Joost-Pieter Katoen. Principles of model checking. MIT Press, 2008.
4. Aldini, M. Bernardo, and F. Corradini. A Process Algebraic Approach to Software Architecture. SpringerVerlag, 2010.
5. Michael Huth and Mark Ryan. 2004. Logic in Computer Science: Modelling

and Reasoning about Systems. Cambridge University Press, New York, NY, USA.

**OUTCOMES :**

Students to complete this course will be able to

- Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.
- Develop automatic tools for software quality analysis based on software metrics.
- An ability to work in one or more significant application domains
- How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
- To apply automatic software verification tools based on model checking.

**CSDY 020 AGILE SOFTWARE DEVELOPMENT**

| L | T | P | C |
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**OBJECTIVES:**

- To familiarize with the basic software development life cycle models.
- To learn about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To learn the basics about development cycles, IT Operations & faster innovation.
- To learn about Continuous Integration (CI) and Continuous Delivery (CD) for quicker & continuous software release/delivery.
- To give knowledge of how DevOps could help reduce complexity in developing and deploying code.
- To create reports and dashboard for effective project management.

**PREREQUISITES :** Software Engineering &Cloud Computing

**MODULE I SOFTWARE DEVELOPMENT MODELS 9**

Software Process – Software development Life cycle models (SDLC) – Basic Software development Life cycle models - Water fall model – V model – Matrix based model – Prototyping.

**MODULE II INTRODUCTION TO AGILE 9**

Design thinking – History of Agile – Agile principles – Benefits of agile – Agile Vs Waterfall - Agile Methodology Overview - Agile Approaches on Large Projects in Large Organizations.

**MODULE III AGILE SOFTWARE DEVELOPMENT 9**

Agile frameworks – Extreme programming - Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD) - Scrum - Kanban Methodology – Agile and Devops - Software Development using Extreme Programming and Scrum Framework.

**MODULE IV DEVOPS 9**

Introduction to DevOps – DevOps vs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD & DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration – Continuous Testing – Continuous Monitoring.

**MODULE V AGILE SOFTWARE DEVELOPMENT WITH JIRA 9**

JIRA Ecosystem – Getting started with JIRA - Managing work items – Running project in JIRA – Working with Reports – Issue searching and filtering – Dashboard and widgets

**L – 45; Total Hours –45**

**REFERENCES:**


1. Brian Hobbs, Yvan Petit, "Agile Approaches on Large Projects in Large Organizations",1st Edition, Project Management Institute, 2017.
2. Ralf Kneuper," Software Processes and Life Cycle Models: An Introduction to Modelling, Using and Managing Agile, Plan-Driven and Hybrid Processes",1st Edition, Springer, 2018.
3. Joakim Verona, "Practical DevOps, Second Edition: Implement DevOps in your organization by effectively building, deploying, testing, and monitoring code", 2nd Edition, Packt Publishing Ltd, 2018.
4. Oleg Skrynnik, "DevOps - A Business Perspective",1st Edition, Oleksandra Spiegler, Van Haren, 2018.
5. David Harned, "Hands-On Agile Software Development with JIRA: Design and manage software projects using the Agile methodology", 1st Edition, Packt Publishing Ltd, 2018.
6. Kallori Vikram, "Introduction to DevOps" ,1st Edition, Kallori Vikram Publication, 2016.


**OUTCOMES :**

Students to complete this course will be able to

- Identify the problems and challenges in Software development lifecycle models.
- Implement agile software methodology for faster development of quality software.
- Describe how to unify processes and improve collaboration between development and operations.
- Implement Automated Installations and Deployments.
- Identify tools and practices for implementing CI, testing, and continuous deployment
- Work with tools/technologies - Git, Maven, Pupet, Junit, Jenkins, Docker & Nagios, JIRA.

| CSDY 021 | SOFTWARE ENGINEERING PROCESS, TOOLS AND METHODS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To enable the students to identify the role of requirement engineering in software engineering.
- To introduce various software design techniques
- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To effectively log and manage identified defects.
- To equip participants with basic knowledge and skills about computer hardware and software maintenance and troubleshooting of common problems.
- To demonstrate the software maintenance processes and tools for maintenance.

**PREREQUISITES :**

- Data Mining
- Database Management

**MODULE I SOFTWARE PROCESS 9**

Software Engineering – Framework – CMMI - Process- Models – Agile Development – System Engineering.

**MODULE II REQUIREMENTS ENGINEERING 9**

Tasks – requirements Process – Eliciting Requirements – Use Cases – Analysis Model – Negotiating & Validating – Requirements analysis.

**MODULE III DESIGN 9**

Design Process – Concepts – Model – Pattern Based Design – Architectural Design – Class Based Components - User Interface Design.

**MODULE IV TESTING 9**

Testing Strategies – Techniques - Testing Web Applications – Risk Identification – SCM Process.

**MODULE V ESTIMATION 9**

Project Estimation – Decomposition Techniques – Estimation Models - SLIM (Software Life Cycle Management) Tools.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Roger. S. Pressman, “Software Engineering A Practitioners Approach”, Eight Edition, Mc Graw Hill, 2016.ISBN-0-07-285318.
2. Ian Sommerville, "Software Engineering”, 10th Edition, Pearson Education India, ISBN: 978-0-1339-4303-0, 2015.
3. Karl E Wiegers , Joy Beatty , "Software Requirements”, 3rd Edition, Microsoft, ISBN: 978-0-7356-7966-5, 2012.

**OUTCOMES :**

Students to complete this course will be able to

- Explore the requirements process and its relationships to the rest of the software development life cycle.
- Develop different design solutions to a given problem and recommend the best one within limitations of cost, time, knowledge, existing systems and organizations.
- Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
- Apply software testing techniques and identify the inputs and deliverables of testing.
- Critically evaluate different software development environments and contexts with respect to the application of appropriate standards and models
- Analyze the types of Estimation Model and apply them to various real time applications.

**CSDY 022 MOBILE AD HOC 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 9**

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

**MODULE II ROUTING PROTOCOLS 9**

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 9**

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 9**

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

**MODULE V QOS AND ENERGY MANAGEMENT 9**

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.

**L – 45; Total Hours –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 LloretMauri, Jesús Hamilton Ortiz,"Mobile Ad Hoc Networks: Current Status and Future Trends" CRC Press, ISBN 9781439856505 ,2012.

**OUTCOMES :**

Students to complete this course will be able to

- Identify the issues in wireless networks and how they can be addressed. Assess the platform architectures that are suitable for Mobile Adhoc networks.
- An ability to understand and analyze the routing concept of mobile ad hoc network

- 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
- Comprehend the design issues in TCP and other transport layer protocols
- An ability to understand the solutions to improve the quality of service in mobile adhoc network

| CSDY 023 | HACKING TECHNIQUES AND DIGITAL FORENSICS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To get in depth knowledge on basics of hacking.
- To learn the various hacking techniques.
- To build web server using Kali linux.
- To perform penetration testing using python.
- To learn the fundamentals of digital forensics.
- To analyze forensics and expose hacking on digital forensics.

**PREREQUISITES :**

- Linux and Python
- Attacks and Security

**MODULE I BASICS OF HACKING 9**

Hacking – Types of hacking – Phases of hacking – Ports & Protocols – Virtualization –Foot printing – Scanning.

**MODULE II PERFORMING THE HACK 9**

Hacking into System – System cracking – Password cracking - Trojans & Backdoors – Viruses & Worms – Spoofing – Spam – Malware – Sniffing, Packet Analysis and Session Hijacking - Social Engineering – Cryptography.

**MODULE III ADVANCE HACKING TECHNIQUES 9**

Denial of Service –-Web application - Build Web server using Kali Linux – Penetration testing using python – Information Gathering – SQL Mapping – Vulnerability analysis.

**MODULE IV DIGITAL FORENSICS 9**

Digital Forensics Goals – Cyber Crime – Digital Forensic Categories- Investigation types – Digital Evidences – Essential technical concepts.

**MODULE V FORENSIC ANALYSIS 9**

Acquiring digital Evidence – Analyzing digital evidence – Windows Forensics analysis- Web Browser and E-mail Forensics – Anti-forensics techniques – Digital forensics Report - Hacking Exposed Computer Forensics.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Jacob Hatcher, “Hacking: Hacking For Beginners and Basic Security: How To Hack”, 2nd Edition, Lulu.com, 2016.
2. Nihad A. Hassan, “Digital Forensics Basics: A Practical Guide Using Windows OS”, 1stEdittion, Apress, 2019.
3. Harsh Bothra, “Hacking: Be a Hacker with Ethics”, 1st Edition, Khanna Publishing, 2017
4. Sanjib Sinha, “Beginning Ethical Hacking with Kali Linux: Computational Techniques for Resolving Security Issues”,1st Edition, Apress, 2018
5. David Cowen, “Hacking Exposed Computer Forensics, Third Edition: Secrets & Solutions”, 3rd Edition, McGraw-Hill Education, 2016.
6. JoakimKävrestad, “Guide to Digital Forensics: A Concise and Practical Introduction”, 1st Edition, Springer, 2017.


**OUTCOMES :**

Students to complete this course will be able to

- Describe the fundamental concepts of hacking.
- Perform various basic and advance hacking techniques.
- Apply hacking techniques using programming tools such as Kali linux and python.
- Explain the basic concepts of digital forensics.
- Analyze digital forensics techniques on various platforms.
- Expose hacking techniques on digital forensics.

**CSDY 024 INFORMATION SECURITY**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To provide an understanding of principal concepts, major issues, technologies and basicapproaches in information security
- To know the legal, ethical and professional issues in Information Security
- To familiarize with the aspects of risk management.
- To know the technological aspects of implementation of Information Security
- To focus on physical security and understand the access models.
- To highlight the salient features of implementation and maintenance of security.
-

**PREREQUISITES :**

- Computer Networks

**MODULE I INTRODUCTION 9**

Introduction-History of Information Security-Need for security-CNSS security model-Components of an information system-Balancing information security and access-System development life cycle-security systems development life cycle-threats-attacks-secure software development-software attacks-Technical hardware failure or errors.

**MODULE II PLANNING FOR SECURITY 9**

Introduction-Information security planning and governance- Information security policy, standards and practices-Cryptographic tools-protocols for secure communications-Attacks on cryptosystems-Legal, Ethical and Professional issues in Information Security -Laws and Ethics in Information Security.

**MODULE III RISK MANAGEMENT 9**

Introduction- Risk identification- assessment- control strategies- selecting a risk control strategy – quantitative versus qualitative risk control practices.

**MODULE IV SECURITY TECHNOLOGY AND PHYSICAL SECURITY 9**

Security Technology - Access Controls, Firewalls and VPNs- Intrusion Detection and prevention systems. Physical Security -Introduction-Physical access controls-

Fire Security and safety-Failure of supporting utilities and structural collapse-Interception of Data-Remote computing security.

**MODULE V INFORMATION SECURITY IMPLEMENTATION AND MAINTENANCE** **9**

Information security project management-technical aspects of implementation-non technical aspects of implementation- Positioning and staffing the security function. Security Management Maintenance Models-Digital Forensics.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Michael E. Whitman and Herbert J. Mattor.,"Principles of Information Security: 6thEdition,Cengage Learning, 2017.
2. John R.Vacca, "Computer and Information Security Handbook**"**, 3rd Edition, Morgan Kaufmann Publishers,2017.
3. Jason Andress,"The Basics of Information Security", 2nd edition, Syngress Press, Elsevier Publications, 2014.


**OUTCOMES :**

Students to complete this course will be able to

- Identify the major types of threats to information security and the associated attacks.
- Describe the major components of security and analyze planning, governance, legal and ethical issues of information security.
- Assess risks and illustrate the different aspects of risk management
- Describe firewall technology and the various approaches to firewall implementation and.
- Emphasize the relationship between information security and physical security.
- Enumerate the organizational considerations to be addressed in a project plan and describe the maintenance issues of security.

| CSDY 025 | MOBILE AND WIRELESS NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the concepts of wireless and mobile network security
- To Provide security for mobile telecommunication networks
- To have a broad overview of the Wifi and Bluetooth security
- To learn the security issues in IP based mobile networks
- To discuss the security mechanism followed in adhoc and sensor networks
- To expose students to emerging technologies of mobile and wireless networks

**MODULE I INTRODUCTION** **9**

Introduction to Mobile and Wireless Networks-Mobile cellular networks-IEEE wireless networks-Mobile Internet networks.- Vulnerabilities of Wired and Wireless Networks-Security in the digital age-Threats and risks to telecommunications systems-From wireline vulnerabilities to vulnerabilities in wireless communications

**MODULE II WIFI AND BLUE TOOTH SECURITY** **9**

Wi-Fi Security Dedicated Architectures-Hot spot architecture: captive portals-Wireless intrusion detection systems (WIDS)- Wireless honeypots-Bluetooth Security-Bluetooth technical specification-Bluetooth security-Wi-Fi Security-Attacks on wireless networks-Security in the IEEE 802.11 standard-. Security in 802.1x-Security in 802.11i--Authentication in wireless networks-WiMAX Security.

**MODULE III SECURITY IN MOBILE TELECOMMUNICATION NETWORKS** **9**

Signaling-Security in the GSM-GPRS security-3G security-Network interconnection-Security of Downloadable Applications

**MODULE IV EMERGING TECHNOLOGIES** **9**

Security in Next Generation Mobile Networks.-SIP-. VoIP-IP Multimedia Subsystem (IMS)- 4G security-Confidentiality-Security of IP-Based Mobile Networks .- Security in Ad Hoc Networks.- Wireless Sensor Network Security

**MODULE V RESEARCH DIRECTIONS IN SECURITY AND PRIVACY FOR MOBILE AND WIRELESS NETWORKS** **9**

Security and Privacy in 4G/LTE Network-Security for 5G Mobile Wireless Networks-

Attacks and Security Services in 5G Wireless Networks-Security Services in 5G Wireless Networks --State-of-the-Art Solutions in 5G Wireless Security-Security for Technologies Applied to 5G Wireless Network Systems--Challenges and Future Directions for 5G Wireless Security

**L – 45; Total Hours –45**

**REFERENCES:**


1. Georgios Kambourakis , Felix Gomez Marmol and GuojunWang,Security and Privacy in Wireless and Mobile Networks, Future Internet,MDPI, 2018
2. Dongfeng Fang, Yi Qian,,RoseQingyang Hu,, Security for 5G Mobile Wireless Networks-IEEE Access, 2017
3. HakimaChaouchiMaryline Laurent-Maknavicius, "Wireless and Mobile Network Security Security Basics, Security in On-the-shelf and Emerging Technologies", Wiley, 2009
4. S. Kami Makki,Peter Reiher,Kia Makki,Niki Pissinou,ShamilaMakki,," Mobile and Wireless Network Security and Privacy ", Springer, 2007
5. Lei Chen Jiahuang Ji Zihong Zhang, Wireless Network Security Theories and Applications, Springer, 2013
6. NourMoustafa, JiankunHu,Security and Privacy in 4G/LTE Network, Research Gate, 2018


**OUTCOMES :**

Students to complete this course will be able to

- Gain knowledge on the concepts of wireless and mobile network security
- Analyze the different security threats in Wifi, Bluetooth and wimax
- Identify the various security risks in mobile telecommunication networks
- Investigate the solutions for security threats to ad hoc networks and sensor networks
- Know how to secure 4G and 5G wireless networks from various attacks
- Get the knowledge on different attacks and security services in future generation mobile wireless and mobile networks

| CSDY 026 | WIRELESS NETWORKS | 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.

**L – 45; Total Hours –45**

**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 to 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.

**CSDY 027 MOBILE APPLICATION DEVELOPMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To understand how to work with various mobile application development frameworks
- To understand the basics of Android devices and Platform.
- To acquire knowledge on basic building blocks of Android programming required for App development.
- To expose the Knowledge on Xcode Project and how its transformed to app
- Develop skills and devise strategies to build versatile and flexible apps that meet changing business requirements
- To identify the complete end-to-end mobile device management.

**PREREQUISITES :**

- Programming Language
- Open Source

**MODULE I INTRODUCTION 9**

Introduction to mobile application development, trends, introduction to various platforms. Android – Getting Started – Android Development tools –Applications and Activities and Fragments.

**MODULE II SWIFT LANGUAGE 9**

The Architecture of Swift: The structure of Swift File, Design – Functions: Function Parameters and Return Value, External Parameter Names, Closures, Curried Functions – Variables and simple types: Variable Scope and Life Time, Build – In simple Types.

**MODULE III SWIFT : OBJECT TYPES, FLOW CONTROL 9**

Object Types: Declarations and Features, Enums, Structs, Classes, Polymorphism, Protocols, Extensions, Umbrella Types, Collection Types – Flow Control: Flow control, Privacy, Memory Management.

**MODULE IV XCODE 9**

Anatomy of an Xcode Project – Nib Management – Life cycle of a project - Create an application using Xcode

**MODULE V LEAN TO BUILDING MOBILE APPS 9**

. Challenges and applying to lean to building Mobile Apps, An Agile Workflow in a Nutshell: An Agile workflow, Epic, Stories, and Tasks, Tool that can use.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Reto Meier and Ian Lake, “Professional Android”, 4th Edition, Wrox A Wiley Brand, ISBN: 9781118949528, 2017.
2. Matt Neuburg,“iOS 12 Programming Fundamentals with Swift Swift, Xcode, and Cocoa basics”, 5th Edition, O’Relliy, USA 2018.
3. Hazem Saleh, Ethan Holmes, Tom Bray, Sani Yusuf, “Mobile Application Development: JavaScript Frameworks”, 1st Edition,Pack Publishing Ltd, UK, ISBN: 978-1-78712-995-5, 2016.
4. Mike van Drongelen, Adam Dennis, Richard Garabedian, Alberto Gonzalez, Arvind Krishnaswamy, “Lean Mobile App Development”, 1st Edition, Pack Publishing Ltd, UK, 2017.


**OUTCOMES :**

Students to complete this course will be able to

- Design and Implement various mobile applications using emulators
- Deploy applications to hand-held devices
- Develop the user interface using Swift on iOS
- Deploy with platform specific application on iOS
- Adopt the lean startup methodologies to develop iOS and Android apps that shine in the App Store
- Deploy with platform specific application on android and iOS

**CSDY 028 RFID AND MICROCONTROLLER**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To Understand the basic building blocks of RFID.
- Familiarize the different kinds of RFID, usage, and deployment details.
- Understand the key factors for RFID deployment.
- To learn 8051 microcontroller.
- To develop real time applications based on microcontrollers
- Analyze different case studies.

**MODULE I INTRODUCTION OF RFID** **9**

Automatic Identification Systems – A Classification of ID systems – Components of an RFID System- Features of RFID systems - Layer by Layer-OSI Model and the RFID Interface.

**MODULE II RFID APPLICATIONS** **9**

Short range RFID applications- access control - personal identification - Transportation ticketing- blood, tissue and organ identification- fleet management- personal identification- car body production-passport security. Long range RFID applications- supply chain management- Mail and shipping- Clothing Tags.

**MODULE III MICROCONTROLLERS 8051** **9**

Intel 8051 - architecture- memory organization- special function registers timing and control- port operation- memory interfacing - I/O interfacing Programming the 8051 resources- interrupts- Measurement of frequency, period and pulse width of a signal- power down operation.

**MODULE IV INTEL 8051 MICROCONTROLLER - INSTRUCTION SET AND PROGRAMMING** **9**

Programmers model of Intel-Operand types- Operand addressing- Data transfer instructions- Arithmetic Instructions - Logic instructions- Control transfer instructions.- 8051 Interfacing and applications.

**MODULE V CASE STUDIES** **9**

Reading RFID cards using 8051- RFID in the supply chain- Vehicles parking using RFID- library management system- electronic toll payment smart shipping

containers- fleet monitoring and management.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Ali Miri, “Advanced Security and Privacy for RFID Technologies”, 1st Edition, IGI Global Publisher, 2013.
2. Klaus Finkenzeller, “RFID Handbook”, 3rd Edition, John Wiley & Sons, 2010.
3. Ajit Pal, "Microcontrollers- principles and applications", Prentice hall of India, 2011.
4. Dennis E. Brown , " RFID implementation" Tata McGraw - Hill, 2007
5. Syed Ashon Mohammed Ilyas, “RFID HANDBOOK Applications, Technology”, Security, and Privacy, CRC Press 2008.
6. Steven Shepard, "RFID: Radio frequency and Identification", Tata McGraw - Hill.
7. Krishna Kant. " Microprocessors and Microcontrollers", Prentice hall of India,2011
8. www.circuitstoday.com/interfacing-rfid-module-to-8051.


**OUTCOMES :**

Students to complete this course will be able to

- Understand the basic components and applications of RFID systems.
- Identify how to evaluate a RFID project and create estimation with deployment plans.
- Describe Interfacing mechanism and frequency ranges of RFID systems.
- Explore the data transformation procedure with microcontroller.
- Evaluate the key factors for RFID deployment and business process adaption.
- Discuss how RFID is being used today across the world.

| CSDY 029 | KNOWLEDGE ENGINEERING AND EXPERT SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To identify the knowledge of engineering.
- To learn the concepts of knowledge base and information management.
- To solve the constructive problem.
- To discuss the expert systems.
- To explaining architecture of expert system.
- To understanding the programming language with expert systems.

**MODULE I INTRODUCTION OF KNOWLEDGE ENGINEERING 9**

Trends in Knowledge of Engineering: Introduction to knowledge engineering, Limitations and Possibilities of knowledge engineering, Business Management Styles, Management Styles and Information Technology, Management Source of Information, Information Processing, Multidimensional Management Systems (MMS), Computer-Aided Decision-Making (CAD), Organization Marketing, Virtual Management, Computer-Aided Management and Communications.

**MODULE II ISSUES IN KNOWLEDGE ENGINEERING AND EXPERT SYSTEM 9**

Problem solving strategies, Knowiedgewux Information Engineering Workbench, The Systematic-Intuitive Approach, Information Engineering Workbench, Language and Perceptual Models, Standards of expert system, Inference, Reasoning, and Knowledge Acquisition.

**MODULE III PROBLEM SOLVING PROCESS 9**

Rule Based Systems – Heuristic Classifications – Constructive Problem Solving.

**MODULE IV EXPERT SYSTEMS 9**

Tools For Building Expert Systems - Case Based Reasoning – Semantic Of Expert Systems – Modeling Of Uncertain Reasoning – Applications Of Semiotic Theory; Designing For Explanation.

**MODULE V EXPERT SYSTEM ARCHITECTURE AND PROGRAMMING** **9**

Expert System Architectures - High Level Programming Languages – Logic Programming For Expert Systems.

**L – 45; Total Hours –45**

**REFERENCES:**


1. By Thomas B. Cross, “Knowledge Engineering 2017 The Uses of Artificial Intelligence in Business”, TECHtionary Corporation, 2017.
2. Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education 2007.
3. Jean-Louis Ermine, “Expert Systems: Theory and Practice”, 4th printing, Prentice-Hall of India, 2001.
4. Padhy N.P, “Artificial Intelligence and Intelligent Systems”, 4th impression, Oxford University Press, 2007.
5. Robert I. Levine, Diane E. Drang, Barry Edelson: “AI and Expert Systems: a comprehensive guide, C language”, 2nd edition, McGraw-Hill 1990.


**OUTCOMES :**

Students to complete this course will be able to

- Apply knowledge in logical form and construct ontology for different domains.
- Identified the knowledge engineering issues and implement the workbench process.
- Knowledge gathered in expert systems.
- Analyze the classification and constructive problem solution.
- Tools identification of expert system.
- Understand the flow of expert system architecture and programming logic in expert system.

**CSDY 030 AGENT BASED INTELLIGENT SYSTEMS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**PREREQUISITES:**

- Artificial Intelligence

**MODULE I INTRODUCTION** **9**

Introduction to Artificial Intelligence – Problem solving with AI – Uninformed search – General search algorithms – Informed search – Memory bounded heuristic search – Local search algorithms and optimization problems.

**MODULE II INTELLIGENT AGENT** **9**

Intelligent Agent – rational agent – task environment and its properties – Types of Agent – Constraint Satisfaction Problem – Backtracking search for CSP – Forward checking – Intelligent backtracking.

**MODULE III KNOWLEDGE BASED AGENTS** **9**

Knowledge Representation – Logic – Propositional logic – Predicate logic -First Order Logic – Unification and lifting – Representation of knowledge using rules – Uncertain knowledge and reasoning – Probabilistic reasoning.

**MODULE IV PLANNING AND LEARNING** **9**

Planning Problem – Planning Agent – Planning language – Hierarchical Planning – Knowledge based planning – Multi agent planning – Learning – Scope of Machine learning – Learning Methods and models – Artificial Neural Network based learning – Multi agent based Learning.

**MODULE V RECENT TRENDS WITH ARTIFICIAL INTELLIGENCE 9**

Architecture of expert system – Knowledge Acquisition – Natural Language Processing – Fuzzy and hybrid Intelligence system –Cloud Computing and Intelligent agents – Business Intelligence and analytics – Big Data and sensory Processing.

**L – 45; Total Hours –45**

**REFERENCES:**

1. ParagKulkarni, Prachi Joshi, “Artificial Intelligence: Building Intelligent Systems, 1st Edition, PHI,2015.
2. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2010.
3. NgoocThanhNguyaaen, Lakhmi C. Jain, “Intelligent Agents in the Evolution of Web and Applications”, 4th Edition, Springer, 2009. .
4. ZiliZhang,Chengqi Zhang, “Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving”, 1st Edition, Springer-Verlag New York, LLC , 2004.

**OUTCOMES :**

Students to complete this course will be able to

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

| CSDY 031 | DEEP LEARNING TECHNIQUES | 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.

**PREREQUISITES:** Computer Network

**MODULE I SPEECH TECHNOLGY** **9**

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

**MODULE II TRANING NETWORK** **9**

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

**MODULE III NETWORK MODEL** **9**

Feature Representation Learning in Deep Neural Network –Deep Neural Network - Fuse Deep Neural Network -Gaussian Mixture Model Systems-Adaptation of Deep Neural Networks

**MODULE IV REPRESENTATION OF LEARNING NETWORK** **9**

Feature Representation Learning in Deep Neural Network –Deep Neural Network -Fuse Deep Neural Network -Gaussian Mixture Model Systems-Adaptation of Deep Neural Networks.

**MODULE V ADVANCED DEEP MODELS** **9**

Representation Sharing and Transfer -Multiobjective Training of Neural Network for speech recognition-Multilingual and Cross Lingual Speech Recognition-Robust Speech Recognition Exploiting – Recurrent Neural Network-Related Models – Computational Network.

**L – 45; Total Hours –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: 978-1-11997088-0, 2013.

**OUTCOMES :**

Students to 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.

| CSDY 032 | 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 - CountingWords - Unsmoothed N-grams – SmoothingBackoff - 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 Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, 1999.
4. Imed Zitouni, “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

**CSDY 033 ROBOTICS AND INTELLIGENT SYSTEMS**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To introduce the functional elements of Robotics
- To impart knowledge on setting software and hardware construction of the robot.
- To introduce the concepts Robot design process
- To educate on various path planning techniques
- To Learn about planning and reasoning artificial intelligence.
- To Solve the risk in artificial intelligence.

**PREREQUISITES :**

- Engineering Mathematics
- Database Management

**MODULE I INRTODUCTION** **9**

Principle of robotics and AI – Advanced robotics techniques – Development environment – System and decision making framework – The robot control system.

**MODULE II SETTING UP ROBOTS** **9**

Robot Anatomy – Subsumption architecture – software setup – Hardware – Use case – Story board.

**MODULE III ROBOT DESIGN PROCESS** **9**

Image recognition process – Neural network – Picking up the toys: Task Analysis, Teaching the robot arm, Other robot arm machine learning approaches – Teaching a Robot to listen: Robot Speech recognition.

**MODULE IV ALGORITHM** **9**

Decision trees, Entropy, Random forest, Grid searching and A* algorithm, GPS path finding.

**MODULE V AI IN ROBOTICS** **9**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Francis X. Govers, “Artificial Intelligence for robotics”, 1st Edition, Packt publishing Ltd, UK, ISBN :978-1-78883-544-2, 2018
2. Peter Sincak, Pitoyo Hartono, Maria Vircikova, Jan Vascak, Rudolf Jaksa, “Emerging Trends in Robotics and Intelligent Systems”, 1st Edition, Springer Cham Heidelberg New York Dordrecht London, 2015, ISBN : 978-3-319-10783-7.
3. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3 rd Edition, Pearson, ISBN: 9780136042594, 2010.

**OUTCOMES :**

Students to complete this course will be able to

- Ability to understand basic concept of robotics.
- To analyze Instrumentation systems and their applications to various
- To know about the various design process.
- To know about the various path planning techniques
- Implement basic AI algorithms.
- Design and carry out an empirical evaluation of different algorithms on problem formalization.

**CSDY 034 INTELLIGENT INFORMATION RETRIEVAL**

| L | T | P | C |
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**OBJECTIVES:**

- To teach about the information retrieval systems.
- To introduce the students to design, implementation, and evaluation of information retrieval systems, such as Web search engines.
- To expose the students to emerging technologies to build the next generation of intelligent and personalized search tools and Web information systems.
- To describe the students to underlying retrieval models, algorithms, and system implementations, such as vector-space and probabilistic retrieval models, as well as the PageRank algorithm used by Google.
- To expose the students to intelligent information retrieval and filtering, particularly on the World Wide Web, including techniques for document categorization, automatic concept discovery, recommender systems, discovery and analysis of online communities and social networks, and personalized search.

**PREREQUISITES :** Data structures

**MODULE I OVERVIEW AND BACKGROUND 9**

Overview of Information Retrieval Systems – Boolean Retrieval Dictionaries - Indexes.

**MODULE II COMPUTING SCORES IN A SEARCH SYSTEM 9**

Efficient scoring and ranking - Inexact top K document retrieval - Index elimination - Champion lists -- Static quality scores and ordering - Impact ordering - Cluster pruning - Components of an information retrieval system- Tiered indexes - Query-term proximity - Designing parsing and scoring functions - Vector space scoring and query operator interaction.

**MODULE III EVALUATION IN INFORMATION RETRIEVAL 9**

Information retrieval system evaluation- Standard test collections - Evaluation of unranked retrieval sets - Evaluation of ranked retrieval results - Assessing relevance- Critiques and justifications of the concept of relevance.

**MODULE IV RETRIEVAL MODELS AND CLUSTERING 9**

Similarity Measures and Ranking – Boolean Matching – Vector Space Models- Probabilistic Models. Relevance Feedback – User Profiles – Collaborative Filtering – Document and Term Clustering – Document Categorization.

**MODULE V FILTERING TECHNIQUES AND CLUSTERING 9**

Information Retrieval Systems and the WWW – PageRank and Hyperlink Analysis – Search Personalization – Web Mining and Its Applications.

**L – 45; Total Hours –45**

**REFERENCES:**

1. Christopher Manning, Prabhakar Raghavan and Hinrich Schutze, “Introduction to Information Retrieval” ,Cambridge University Press, 2009.[Available online: https://nlp.stanford.edu/IR-book/]
2. Grossman, David A., Frieder, and Ophir, “Information Retrieval”, Algorithms and Heuristics, ISBN:978-1-4020-3005-5, 2004.
3. Online course material : http://facweb.cs.depaul.edu/mobasher/classes/csc575/lecture.html
4. https://nlp.stanford.edu/IR-book/pdf/irbookonlinereading.pdf

**OUTCOMES :**

Students to complete this course will be able to

- Apply the basic concepts and techniques of Information Retrieval in various related fields.
- Develop skills in problem solving using basic retrieval techniques
- Apply document indexing to real world problems by learning the indexing models.
- Analyze different information retrieval techniques in various application areas.
- Evaluate the use of filtering techniques and clustering in various applications areas.
- Illustrate the use of information retrieval techniques in World Wide Web.

**CSDY 035** **SOFT COMPUTING**

| L | T | P | C |
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**OBJECTIVES:**

- 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 Genitic Algorithms and its Operators.

**PREREQUISITES :**

- Artificial Intelligence

**MODULE I BASICS** **9**

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

**MODULE II ARTIFICIAL NEURAL NETWORK** **9**

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** **9**

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

**MODULE IV NEURO FUZZY SYSTEMS** **9**

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 GENETIC ALGORITHMS 9**

Genetic Algorithms and optimization – Genetic Algorithm operators - Encoding, Crossover Selection etc - Genetic algorithms with Neural/Fuzzy systems – Basic GA framework - Variants of Genetic Algorithms–Population based incremental learning.

**L – 45; Total Hours –45**

**REFERENCES:**


1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013.
2. S.Rajasekaran, G.A.VijayalakshmiPai, “Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications “, PHI Learning Pvt. Ltd., 2017.
3. N.P.Padhy, S.P.Simon, “Soft Computing with MATLAB Programming”, Oxford University Press, 2015.
4. S.N.Sivanandam , S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt. Ltd., 2nd Edition, 2011
5. Asa Bensten ,” Genetic Algorithms in Applications “,Scitus Academics LLC, 2016


**OUTCOMES :**

Students to complete this course will be able to

- Apply suitable soft computing techniques for various applications.
- Apply neural networks to pattern classification and regression problems
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Demonstrate some applications of Genetic Algorithms.
- Discuss the neural networks and supervised and unsupervised learning networks.
- Evaluate and compare solutions by various soft computing approaches for a given problem

# GENERAL ELECTIVES

| GEDY101 | PROJECT MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES:**

The objectives of the course would be to make the students

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

**MODULE I INTRODUCTION & PROJECT INITIATION 09**

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

**MODULE II RISK ANALYSIS 09**

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

**MODULE III PROJECT PLANNING & IMPLEMENTATION 09**

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

**MODULE IV TECHNICAL ANALYSIS 09**

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

**MODULE V PROJECT MANAGEMENT TECHNIQUES 09**

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

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

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

**GEDY102 SOCIETY, TECHNOLOGY & SUSTAINABILITY**

| L | T | P | C |
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**OBJECTIVES:**

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

**MODULE I TECHNOLOGY AND ITS IMPACTS 09**

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

**MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09**

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

**MODULE III SOCIETY AND TECHNOLOGY 09**

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

**MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09**

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

**MODULE V THE IMPORTANCE OF SUSTAINABILITY 09**

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

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

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

| GEDY103 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
|---|---|---|---|---|---|
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**OBJECTIVES:**

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

**MODULE I HISTORY AND FOUNDATIONS 08**

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

**MODULE II SEARCH 10**

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

**MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10**

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

**MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08**

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

**MODULE V CASE STUDY AND FUTURE APPLICATIONS 09**

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

**Total Hours: 45**

**TEXT BOOK:**

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

**OUTCOMES:**

Students who complete this course will be able to

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

**GEDY104 GREEN COMPUTING L T P C**
**3 0 0 3**

**OBJECTIVES:**

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

**MODULE I INTRODUCTION 08**

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

**MODULE II CONSUMPTION ISSUES 10**

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

**MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09**

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

**MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08**

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

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

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

**Total Hours: 45**

**REFERENCES:**


1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.


**OUTCOMES:**

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.

- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

**GEDY105 GAMING DESIGN L T P C**
**3 0 0 3**

**OBJECTIVES:**

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

**MODULE I INTRODUCTION 09**

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

**MODULE II THE DESIGNER CREATES AN EXPERIENCE 09**

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

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

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

**MODULE IV GAMES THROUGH AN INTERFACE 09**

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

**MODULE V BALANCED GAME MECHANICS 10**

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

**Total Hours: 45**

**REFERENCES:**

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie SalenTekinba, 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

| GEDY106 | SOCIAL COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**MODULE I BASIC CONCEPTS 09**

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

**MODULE II SOCIAL LINK 09**

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

**MODULE III SOCIAL MEDIA 08**

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

**MODULE IV SOCIAL INFORMATION FILTERING 09**

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

**MODULE V SOCIAL NETWORK STRATEGY 10**

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

**Total Hours: 45**

**REFERENCES:**


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


**OUTCOMES:**

Students who complete this course will be able to

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

| GEDY107 | SOFT COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

The aim of the course is to

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

**MODULE I SOFT COMPUTING - BASICS 06**

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

**MODULE II ARTIFICIAL NEURAL NETWORK 12**

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

**MODULE III FUZZY SYSTEMS 09**

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

**MODULE IV NEURO FUZZY SYSTEMS 09**

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

**MODULE V EVOLUTIONARY COMPUTING 09**

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

**Total Hours: 45**

**TEXTBOOKS:**

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

**OUTCOMES:**

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

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

**GEDY108 EMBEDDED SYSTEM PROGRAMMING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09**

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

**MODULE II SOFTWARE TECHNOLOGY 09**

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

**MODULE III INPUT/OUTPUT PROGRAMMING 09**

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

**MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09**

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

**MODULE V EMBEDDED C 09**

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

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

**GEDY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES:**

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

**MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09**

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

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

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

**MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09**

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

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

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

and Agriculture –sustainable livelihoods.

**MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09**

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

**Total Hours: 45**

**REFERENCES:**

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

**OUTCOMES:**

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

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

| GEDY110 | QUANTITATIVE TECHNIQUES IN MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

To impart knowledge on

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

**MODULE I OPERATIONS RESEARCH 09**

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

**MODULE II PRODUCTION MANAGEMENT 09**

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

**MODULE III FINANCIAL MANAGEMENT 09**

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

**MODULE IV DECISION THEORY 09**

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

**MODULE V MANAGERIAL ECONOMICS 09**

Cost concepts–Breakeven 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.

**OUTCOMES:**

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

**GEDY111 PROGRAMMING USING MATLAB & SIMULINK**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 2 | 2 |

**OBJECTIVES:**

The aim of this course is to:

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

**MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10**

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

**Lab Experiments**

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

**MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10**

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

**Lab Experiments**

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

**MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13**

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

**Lab Experiments**

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

b. Euler method

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

**MODULE IV INTRODUCTION OF SIMULINK 12**

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

**Lab Experiments**

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

**Total Hours (Including Practicals): 45**

**REFERENCE:**


1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. LaureneFausett, “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

**GEDY 112 JAVA PROGRAMMING L T P C**
**3 0 0 3**

**OBJECTIVES:**

- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods with ability handle abnormal conditions.
- To learn to work with various string methods and collection framework.
- To establish a connection to database from java application.
- To understand why Java is useful for the designing web applications.
- To design a graphical user interface (GUI) with Java Swing.

**MODULE I INTRODUCTION TO JAVA PROGRAMMING 06**

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

**MODULE II METHODS AND CLASSES 08**

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

**MODULE III STRING HANDLING AND COLLECTIONS 07**

String Handling - Special String Operations - String Literals- String Conversion - Collections Overview - The Collection Interfaces -The Collection Classes - Accessing a collection Via an Iterator - Working With Maps, Comparators.

**MODULE IV DATABASE CONNECTIVITY 08**

JDBC - JDBC Driver Types - JDBC Packages - Database Connection - Associating the JDBC/ODBC Bridge with the Database - Statement Objects – Result Set - Transaction Processing – Metadata - Exceptions.

**MODULE V SERVER PROGRAMMING 09**

The Life Cycle of a Servlet - Using Tomcat for Servlet Development -The Servlet API - Handling HTTP Requests and Responses - Using Cookies - Session Tracking - Java Server Pages (JSP)-Session Objects

**MODULE VI SWING PROGRAMMING 07**

Concepts of Swing - Java Foundation Class (JFC) - Swing Packages and Classes - Working with Swing - Swing Components

**L – 45; TOTAL HOURS-45**

**REFERENCES :**

1. Herbert Schildt, “Java The Complete Reference”, 11th Edition, McGraw Hill, 2018, ISBN: 9781260440249.
2. Joshua Bloch , “Effective Java Paperback”,3rd Edition, Addison Wesley,2017,ISBN: 978-0134685991.
3. E Balagurusamy, “Programming with Java”, 6th Edition, Tata Mcgraw Hill, 2019,ISBN: 978-9353162344.

**OUTCOMES:**

Students who complete this course will be able to

- Understand the fundamentals java programming language
- Use the Java programming language for various programming technologies.
- Perform various string operations on any given text from user.
- Connect any database with java program and manipulate the contents.
- Write a server side programming which can evaluate the input and respond to user request
- Develop user interface using java swings.

**GEDY 113 PYTHON PROGRAMMING**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**OBJECTIVES :**

- To study the control statements and string functions of python.
- To practice python data structures - lists, tuples, dictionaries.
- To organize input/output with files in Python.
- To learn the python tools as well as Unicode process.
- To explore advance python including decorators and metaclasses.
- To integrate python with embedded systems.

**MODULE I INTRODUCTION TO PYTHON PROGRAMMING 07**

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

**MODULE II LISTS, TUPLES AND DICTIONARIES 08**

Lists - list operations - list slices - list methods - list loop – mutability- aliasing - cloning lists - list parameters - Tuples: tuple assignment- tuple as return value- Dictionaries- operations and methods- advanced list processing - list comprehension- selection sort - insertion sort- merge sort- histogram.

**MODULE III FILES, MODULES AND PACKAGES 08**

Files and exception - text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - word count- copy file.

**MODULE IV UNICODE AND BYTE STRINGS 07**

String basics - coding basic strings –coding Unicode strings- 3.X bytes objects- 3.X/2.6+ byte array object- text and binary files – Unicode files

**MODULE V DECORATORS AND METACLASS 08**

Decorator basics- coding function decorators- coding class decorators – managing functions and classes –the metaclass model- declaring metaclasses-coding metaclasses-inheritance and instance-metaclass methods

**MODULE VI EMBEDDED PROGRAMMING USING PYTHON 07**

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

**L – 45; Total Hours : 45**

**REFERENCES :**


1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369.
3. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
5. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
6. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
7. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.


**OUTCOMES :**

Students to complete this course will be able to

- Implement date and time function programming using python.
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python Programs.
- Instrument the unicode process using python tools
- Build advance python programs using decorators and metaclass.
- Develop embedded system with python programming.

**GEDY114 INTELLECTUAL PROPERTY RIGHTS (IPR)**

| L | T | P | C |
|---|---|---|---|
| 1 | 0 | 0 | 1 |

**OBJECTIVES:**

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

**MODULE I INTRODUCTION 07**

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

**MODULE II PATENT 08**

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

**Total Hours: 15**

**REFERENCES**

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. AjitParulekar 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

**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