SRI SANKARA ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

ENATHUR, KANCHIPURAM – 631 561.

M.Sc Computer Science & Technology

REGULATIONS & SYLLABUS

(Effective from the academic year 2023 - 2024)

Choice Based Credit System

Preamble

The curriculum of the 5-years integrated **M.Sc., Computer Science and Technology** programme offered by Department of Computer Science is prepared in accordance with UGC and Tamil Nadu State Council of Higher Education (TANSCHE). The Programme complies with the Outcome Based Education (OBE) and is designed with relevance to Choice Based Credit System (CBCS) affiliated to the University of Madras.

The curriculum and syllabi conform to the Learning Outcomes-based Curriculum Framework (LOCF) to make it student-centric, interactive and outcome-oriented education for the student's community. The Programme Outcome (PO), Programme Specific Outcome (PSO) and Course Outcome (CO) were discussed and finalized keeping the broad requirements of the programme.

A uniquely designed curriculum for the higher secondary passed-out students to pursue 5-year integrated PG course which provides a blended curriculum comprising of fundamental concepts and advanced research-oriented concepts. The five years of course provides lot of leeway in designing a comprehensive curriculum to cater to the diverse needs of novice-learner in the first year to a pro-learner in the fifth year of graduation. The long span of the course helps to leverage the broader yet deeper aspects of Computer Science to churn out a well-rounded graduate after completion of the course.

A comprehensive and detailed curriculum and syllabi along with Text books and Reference books were framed in a structured approach by deploying Feedback Mechanism on Curriculum from various stakeholders viz. Industry, Potential Employers, Alumni, Academia, Research Organizations and Parents to capture the voice of the respective stakeholders.

The students are offered a well-rounded curriculum that are research-oriented and advanced subjects such as such as Microservices Architecture, communication Network and Wireless Technology, Artificial Neural Network, Internet of Things, parallel computing, among many other courses.

1. Introduction

The field of Computer Science has been on an evolution spree for the past three decades and the state-of-the-art technologies have often been breached day-in and day-out by the emergence of new technologies. The mutual growth of hardware and software has supplemented and complimented each other to propel the field of computer science and expanded the horizons of the field. Computers have invaded into every form of human lives giving them instant solutions for the problems that they encounter in their daily life. So, its safe to say that computers have become an integral part of humankind and inevitable to stay away from its magic.

The field of Computer science has been stretching its contours at a rapid pace so much so that even highly complex problems are being breached with consummate ease with the ever-evolving cutting-edge technologies. The latest topics that are hogging the limelight of late are Machine Learning, Artificial Intelligence, Internet of things, Image Processing, Cloud Computing, Natural Language Processing, etc.,

The 5 years integrated M.Sc. Computer Science and Technology programme aims to blend the fundamentals learnings of Computer Science with cutting-edge technologies and research-endearing subjects in a single capsuled degree. The curriculum is designed so as to enhance the research and problem-solving capabilities, entrepreneurship skill, and skill necessary for cracking the competitive exams such as SET and NET. In particular, the course prepares the students to be employable as Web Developer, Network Administrator, Database Administrator, Data Analyst and a Research Scholar.

The Learning Outcomes-based Curriculum Framework for M.Sc. CST is structured and developed to facilitate the students to achieve the following:

- To acquire basic core competencies in research-oriented papers and higher-end technologies such as Digital Image Processing, Microservices Architecture, Algorithms Design, Communication and Networking.
- To develop an ability to synthesize the learned knowledge to analyze the real-world problems and to propose new self-thought solutions from the acquired knowledge.

- To learn advanced and latest technologies to meet the industry standards and challenges. The course outcomes and objectives are designed to cater to the enlisted purposes.

2. Learning Outcomes-based Curriculum Framework

2.1 Nature and Extent of the M.Sc. CST Programme

The 5-years integrated postgraduate programme in Computer Science & Technology provides a stream of courses targeting fundamental knowledge which infuses core-competencies in Computer Science and basic programming languages as well as creates a temperament for research among technology-savvy graduates.

Curriculum and syllabi framework is intended to introduce students to the advanced computing concepts and higher-end technologies and its applications. It is highly critical in inculcating a strong research-temper in computer science so as to venture into a advanced research and equip them to solve highly complex problems in of computer science. The curriculum in computer science and Technology is reinforced with internship and main-project work to expose the graduates to the corporate standards and procedures and introduce them to hands-on problems.

3. **Graduate Attributes:**

Graduate Attributes (GA) are the qualities, skills and understandings that students should develop during their graduation. These qualities prove to be the characteristics and defining roles of the graduates. Graduate attribute is a key outcome that underpin curriculum planning and development. The graduate attributes are fostered through meaningful learning experiences made available through the curriculum, college experience and a process of critical and reflective thinking.

The graduate attributes can be viewed as qualities as listed subcategories:

- **Critical Thinking:**

Capability to apply analytic thought to a body of knowledge; anlayse and evaluate evidence, arguments, claim, beliefs on the basis of empirical evidence; formulate arguments, critically evaluate practices, policies and theories.

- **Scientific Reasoning:**

Ability to analyse, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-mined and reasoned perspective.

- **Problem Solving and Design:**

Problem solving skills empower students to find methodical solutions to any real-world problems or real-time problems using computational algorithms and solutions. Problem solvers are most sought-after attributes of the graduates form the field of Computer Science. They should possess the ability to clearly understand the problem, think creatively or out-of-the-box thinking and to convert the problem into a computational model to find a scientific solution backed by the theories.

- **Multicultural Competence:**

Process knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

- **Leadership readiness / qualities:**

Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring the team members to engage in the vision and used management skills to guide people to the right destination.

3.1. LIST OF GRADUATE ATTRIBUTES FOR B.SC CS:

GA-1: Ability to apply imaginative and reflective thinking to their studies.

GA-2: Ability to communicate and collaborate with individual and within teams in professional and community settings.

GA-3: Ability to apply mathematics, logic and statistics to the design, development and analysis of software systems.

GA-4: Ability to design components, systems and/or process to meet required specifications.

GA-5: Ability to apply decision making methodologies to evaluate solutions for efficiency, effectiveness and sustainability.

GA- 6: Ability to negotiate difficult social situations, defuse conflict and engage positively in purposeful debate.

4. Qualification Descriptors:

Qualification Descriptors are generic statements that define the outcomes of the graduates. The Qualification descriptors are used as metric by two parties:

The first party is the designer of academic programmes who can use the qualification metrics to measure the achievement of students for the award of the qualification.

The second party is the employers of the graduates who can use the qualification descriptors to assess the quality and capabilities of the graduates holding the qualification.

4.1. Qualification Descriptors for M.Sc. CST

On completion of M.Sc. with Computer Science and Technology, the expected learning outcomes that a student should be able to demonstrate are the following.

QD-1: A systematic, extensive and coherent knowledge and understanding of the field of computer science as whole and its applications, critical understanding of the established theories and number of advanced and emerging issues in the field of Computer Science.

QD-2: Demonstrate comprehensive knowledge, including current research, scholarly and/or profession literature, related to essential and advanced learning areas pertaining to the chosen areas and techniques.

QD-3: Apply one's disciplinary knowledge and transferable skills to new/unfamiliar contexts and to identify and analyse problems and issues and seek solutions to real-life problems.

QD-4: Communicate the results of studies undertaken in Computer Science accurately in a range of different contexts using main concepts, constructs and techniques.

QD-5: Demonstrate subject-related and transferable skills that are relevant to industry and employment opportunities.

Programme Outcomes (POs) and Programme Specific Outcomes (PSOs):

Programme Outcomes (Pos)	**PO1: Problem Solving Skill** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication Skill** Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill**

	Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill** Inculcate contemporary business practices to enhance employability skills in the competitive environment. **PO7: Entrepreneurial Skill** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence** Possess knowledge of the values and beliefs of multiple cultures and A global perspective. **PO 10: Moral and ethical awareness/reasoning** Ability to embrace moral/ethical values in conducting one's life.
Programme Specific Outcomes (PSOs)	**PSO1 – Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO 2 - Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that

	will facilitate startups and high potential organizations. **PSO3 – Research and Development** Design and implement HR systems and practices grounded in researches that comply with employment laws, leading the organization towards growth and development. **PSO4 – Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5 – Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

5. Regulation and Syllabus

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

Sl.No	Level	Parameter	Description
1	K1	Knowledge / Remembering	It is the ability to remember the previously learned
2	K2	Comprehension / Understanding	The learner explains ideas or concepts
3	K3	Application / Applying	The learner uses the information in a new way
4	K4	Analysis / Analysing	The learner distinguishes among different concepts
5	K5	Evaluation / Evaluating	The learner justifies a stand or decision
6	K6	Synthesis / Creating	The learner creates a new product of point of view

CHOICE BASED CREDIT SYSTEMREGULATIONS

5.1 ELIGIBILITY FOR ADMISSION:

Candidates seeking admission to the first year of the integrated M.Sc. Computer Science and Technology course shall be required to have passed Higher Secondary Examination conducted by Government of Tamil Nadu or an examination accepted as equivalent thereto by the syndicate, with Mathematics & Physics.

6.1ELIGIBILITY FOR THE AWARD OF DEGREE

5.2 B.Sc CST

A Candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study in a Autonomous College for a period of not less than three academic years, passed the examinations of all the Six Semesters prescribed earning **140** credits in Parts-I, II, III, IV, V & VI and fulfilled such conditions as have been prescribed therefore. The parent university will award degrees to the students evaluated and recommended by autonomous colleges. The degree certificates will be in a common format devised by the university. The name of the college will be mentioned in the degree certificate, if so desired. The declaration of results was decided by the examination committee.

5.3 M.Sc CST

A Candidate shall be eligible for the award of the Degree only if he / she has undergone the prescribed course of study in a Autonomous College for a period of not less than five academic years, passed the examinations of all the ten Semesters prescribed earning 231 (140+91) credits in Parts-I, II, III, IV & V and fulfilled such conditions as have been prescribed therefore. The parent university will award degrees to the students evaluated and recommended by autonomous colleges. The degree certificates will be in a common format devised by the university. The name of the college will be mentioned in the degree certificate, if so desired. The declaration of results was decided by the examination committee.

5.4 DURATION

Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year shall comprise the third and fourth semesters, the third academic year shall comprise the fifth and sixth semesters, the fourth academic year shall comprise the seventh and eighth semester, the fifth academic year shall comprise the nineth and tenth semesters respectively.

The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester exclusive of the days for the conduct of semester examinations.

In each semester, Courses are administered in 15 teaching weeks and another 5 weeks are utilized for evaluation and grading purposes. Each week has 30 working hours spread over in a 5 day week. Depending upon the content and specialization, a paper may have 1 to 6 credits. Total number of teaching hours in a semester will be 450 hrs.

5.5MEDIUM OF INSTRUCTION

The medium of instruction shall be English.

5.6 COURSE OF STUDY

A Master‟s programme consists of a number of papers. The term Course is used to indicate logical part of a subject matter of the programme. In each of Master‟s programmes, there will be a prescription of (i) language –I (Tamil, Sanskrit or other languages), (ii) language – II (English), (iii) a set of compulsory courses (called core subjects), some optional courses (called elective / allied subjects) and projects, (iv) a set of papers recommended by UGC and TANSCHE (Advanced Tamil / Soft skill / Environmental Studies / Value education), (v) Extension activities.

The detail of the Study for Master Degree Courses shall consist of the following:

PART – I Language Courses (LC) [Tamil / Other Languages]

PART – II English Language Courses (ELC)

PART – III Core Subjects

Allied Subjects Projects / Field work

PART – IV

1. (a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two papers (level will be at 6th Standard).
   (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two papers.

(c) Others who do not come under a + b can choose non-major elective comprising of two papers.

2. Skill Based Subjects - Soft Skills

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed papers on Soft Skills. For three years PG degree Programme, a candidate must undergo a minimum of 2 papers (2 x 2 = 4 credits). Papers will be finalized in due course.

3. Environmental Studies

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed paper on Environmental studies. For three years UG degree Programme, a candidate must undergo environmental studies during third semester of second year (2 credits). Syllabus is common to all UG courses.

4. Value Education

A candidate shall be eligible for the award of the degree only if he/she has undergone the prescribed paper on value education. For three years UG degree Programme, a candidate must undergo value education during fourth semester of second year (1 credit). Paper will be finalized in due course.

PART – V Extension Activities

A candidate shall be awarded a maximum of 1 Credits for Compulsory Extension Service. All the Students shall have to enroll for NSS /NCC/ NSO (Sports & Games) Rotract / Youth Red cross or any other service organizations in the college and shall have to put in Compulsoryminimum attendance of 40 hours which shall be duly certified by the Principal of the collegebefore 31st March in a year. If a student LACKS 40 HOURS ATTENDANCE in the First year, he/she shall have to compensate the same during the subsequent years. Students those whocomplete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT. Literacy and population Education Field Work shall be compulsory components in the above extensionservice activities. The working hours should not overlaps the normal teaching hours.

PART – VII Internship

Each PG student shall appear for intenship training during the vacation of II Semester for a minimum period of 15 days and shall submit the report to the controller of examinations. Each student is allotted 4 credits on submission of the report.

The following procedure be be followed for Internal Marks:

Theory Papers: Internal Marks

Best Two tests out of 3	10 marks
Attendance	5 marks
Seminar	5 marks
Assignment	5 marks
	25 marks

Break-up Details for Attendance

Below 60%	- No marks
60% to 75%	- 3 marks
76% to 90%	- 4 marks
91% to 100%	- 5 marks

Practical: Internal Marks 40

Attendance	5 marks
Practical Best Test 2 out of 3	30 marks
Record	5 marks

Project:

Internal Marks	Best 2 out of 3 presentations	20 marks
Viva		20 marks
Project Report		60 marks

6. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTERS:

(i) Candidates shall register their names for the First semester examination after the admission in the PG courses.

(ii) Candidates shall be permitted to proceed from the First Semester upto the Final Semester

irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn, sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorised Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

7. PASSING MINIMUM:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 50%(Fifty Percentage) of the maximum marks prescribed for the paper.

c) In the aggregate (External + Internal) the passing minimum shall be of 50% for eachPaper/Practical/Project and Viva-voce.

d) Grading shall be based on overall marks obtained (internal + external).

For M.Sc. Degree Course in Computer Science & Technology (5 year Integrated course)
B.Sc. Degree Course in Computer Science and Technology

A candidate shall be declared to have passed:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 40%(Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.

c) In the aggregate (External + Internal) the passing minimum shall be of 40% .

d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 140 CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree.

8. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

Candidates who secured not less than 60% of aggregate marks (Internal + External) in thewhole examination shall be declared to have passed the examination in the First Class.

All other successful candidates shall be declared to have passed in Second Class.

Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class with Distinction, provided they pass all the examinations (theory papers, practicals, project and viva-voce) prescribed for the course in the First appearance.

9. GRADING SYSTEM:

The term grading system indicates a Seven (7) Point Scale of evaluation of the performances of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade.
SEVEN POINT SCALE (As per UGC notification 1998)

GRADE	GRADE POINT	PERCENTAGE EQUIVALENT
`O‟ = Outstanding	5.50 – 6.00	75 – 100
`A‟ = Very Good	4.50 – 5.49	65 – 74
`B‟ = Good	3.50 – 4.49	55 – 64
`C‟ = Average	3.00 – 3.49	50 – 54
`D‟ = Below Average	1.50 – 2.99	35 – 49
`E‟ = Poor	0.50 – 1.49	25 – 34
`F‟ = Fail	0.00 – 0.49	0 – 24

10. RANKING:

Candidates who pass all the examinations prescribed for the course in the first appearanceitself alone are eligible for Ranking / Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under “Requirements for Proceeding to subsequent Semester” are only eligible for Classification.

11. PATTERN OF QUESTION PAPER:

PART –A (50 words):Answer 10 out of 12 Questions 10 x 1 = 10 marks

PART –B (200 words):Answer 5 out of 7 Questions 5 x 5 = 25 marks

PART –C (500 words):Answer 4 out of 6 Questions 4 x 10 = 40 marks

12. INSTANT EXAMINATION

Candidates who have passed all the theory papers upto 3rd semester and failed in only one paper pertaining to the 4th semester can apply for Instant Examination. Application form with a demand draft for Rs.400/-, drawn in favour of "The Principal, Sri Sankara Arts and Science College, Enathur" should be submitted on or before 10 days after the publication of results. The results are published within 15 days after the date of examinations.

13. PASSING MINIMUM

A candidate shall be declared to have passed:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 50 % (Fifty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.

c) In the aggregate (External + Internal) the passing minimum shall be of 50%.

d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 91 CREDITS in Parts-I, II, III, IV & V. He / She shall also complete one certificate course to qualify for the Degree.

A candidate who fails in any of the unit / project work / Project Report / dissertation / vivavoice shall reappear in that unit / project work / Project Report / Dissertation / viva-voice and pass the examination subsequently.

14. CLASSIFICATION OF SUCCESSFUL CANDIDATES

PART- I CORE SUBJECTS (COURSE): Successful candidates passing the Examinations for the Language and securing the marks 60 percent and above in the aggregate shall be declared to have passed the examination in the FIRST Class. All other successful candidates shall be declared to have passed the examination in the SECOND Class.

PART – II ELECTIVE SUBJECTS (COURSE): Successful candidates passing the examinations for English and securing the marks 60 percent and above in the aggregate shall be

declared to have passed the examination in the FIRST Class. All other successful candidates shall be declared to have passed the examination in the SECOND class.

PART – III Soft skill

Successful Candidate earning of 2 credits for soft skill paper SHALL NOT BE taken into consideration for Classification / Ranking / Distinction.

PART – IV INTERNSHIP

Successful Candidate earning of 2 credits for internship SHALL NOT BE taken into consideration for Classification / Ranking / Distinction.

15. RANKING

Candidates who pass all the examinations prescribed for the Course in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking / Distinction. Provided in the case of Candidates who pass all the examinations prescribed for the Course with a break in the First Appearance due to the reasons as furnished in the Regulations 11(iii) category are only eligible for Classification.

16. APPEARANCE FOR IMPROVEMENT

Candidates who have passed in a theory paper / papers are allowed to appear again for theory paper / papers only once in order to improve his/her marks, by paying the fee prescribed from time to time. Such candidates are allowed to improve within a maximum period of 10 semesters counting from his/her first semester of his/her admission. If candidate improve his marks, then his improved marks will be taken into consideration for the award of Classification only. Such improved marks will not be counted for the award of Prizes / Medals, Rank and Distinction. If the candidate does not show improvement in the marks, his previous marks will be taken into consideration. No candidate will be allowed toimprove marks in the Practical, Project, Viva-voce, and Field work.

17. CONDONATION

Students must have 75% of attendance in each course for appearing the examination. Students who have 74% to 70% of attendance shall apply for condonation in the prescribed formwith the prescribed fee Rs.200/-.Students who have 69% to 60% of attendance shall apply for condonation in prescribed form with the prescribed fee along with the Medical Certificate. Students who have below 60% of attendance are not eligible to appear for the examination. They shall re-do the semester(s) after completion of the programme.

18. RETOTALING

Candidates are permitted to apply for retotaling within 10 days from the date of publication of results. The student should submit request for retotaling in the prescribed format.and pay the feeprescribed per paper.

19. PHOTOCOPY OF ANSWER SCRIPT

Candidates are permitted to apply for obtaining a photocopy of answer paper within 20 days from the date of publication of results. The student should submit request for photocopy of answer script in the prescribed format.

20. REVALUATION

Candidates are permitted to apply for revaluation after obtaining a photocopy of answer paper within 30 days from the date of publication of results. The student should submit request for revaluation in the prescribed format and pay the fee prescribed per paper.

21. MALPRACTICE

Any malpractice by the students debars them from subsequent appearance based on the decisionof the examination committee. In all cases of malpractice their conduct certificates will indicate malpractice.

22. EVALUATION AND GRADING SYSTEM

The performance of a student in each paper is evaluated in terms of percentage of marks with a provision for conversion to grade points (GP). Evaluation for each paper shall be done by a continuous internal assessment by the concerned paper teacher as well as by an end semester examination and will be consolidated at the end of the course.

The term grading system indicates a Ten Point Scale of evaluation of the performances of students in terms of marks obtained in the Internal and External Examination, grade points and letter grade.
Once the marks of the Internal and end-semester examinations for each of the papers are available, they will be added. The marks thus obtained will then be graded as per details provided in Table.

The sum of total performance in each semester will be rated by Grade Point Average (GPA)

while the continuous performance from the second semester onwards will be marked by Cumulative Grade Point Average (CGPA). These two are calculated by the following formulae.

$$GPA = \frac{\text{Sum of [Credits acquired x Grade points]}}{\text{Sum of Credits acquired}}$$

For the calculation of Grade Point Average (GPA), Gi is the grade point awarded; Ci is the credit units earned for the ith paper.

$$CGPA = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

where „Ci" is the Credit earned for the paper i in any semester ; „Gi" is the Grade Point obtained by the student for the paper i and „n" is the number of papers passed in that or CGPA = GPA of all the papers starting from the first semester to the current semester.

Note: The GPA and CGPA shall be calculated separately for the following five parts:

Part I: Core Subject; Part II: Elective Subject, Part III: Skill based subjects, Part IV:Internship and Part V: Certificate course

Marks	Grade Point	CGPA	Letter Point	Classification of Final Result
96 and above	10	9.51 and above	S^+	First Class with Exemplary
91 – 95	9.5	9.01 – 9.50	S	
86 – 90	9.0	8.51 – 9.00	D^{++}	First Class with Distinction
81 – 85	8.5	8.01 – 8.50	D^+	
76 – 80	8.0	7.51 – 8.00	D	
71 – 75	7.5	7.01 – 7.50	A^{++}	First Class
66 – 70	7.0	6.51 – 7.00	A^+	
61 – 65	6.5	6.01 – 6.50	A	
56 – 60	6.0	5.51 – 6.00	B^+	Second Class
51 – 55	5.5	5.01 – 5.50	B	
46 – 50	5.0	4.51 – 5.00	C^+	Third Class
40 – 45	4.5	4.00 – 4.50	C	
Below 40	0	Below 4.00	F	Fail

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

a. the marks obtained for each paper registered in the semester

b. the credits earned for each paper registered for that semester

c. the performance in each paper by the letter grade point obtained

d. the Grade Point Average (GPA) of all the papers registered for that semester and

e. from the second semester onwards, the Cumulative Grade Point Average (CGPA) of all thepapers and

f. the class and grade of the student in the final CGPA

23. TRANSITORY PROVISION

Candidates who have undergone the course of study prior to the academic year 2008-2009 will be permitted to appear for the examinations under those Regulations for a period of three years i.e., up to and inclusive of April/May 2012 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

*M.Sc. COMPUTER SCIENCE AND TECHNOLOGY (5 YEAR INTEGRATED)

Structure of the Course and Evaluation Pattern:

If a candidate is unable to continue this course after the sixth semester, he/she will be awarded B.Sc.(Computer Science & Technology) provided he/she has passed in all subjects up to VI Semester.

First Year

Semester-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil-I	3	4
Part-II	English-I	3	4
Part-III	C and C++ Programming	4	6
	Elective Course 1 - Generic (Any One) – Mathematics I	3	5
	Elective Course 1 - Generic /(Any One) – Physics I	3	5
Part-IV	Ability Enhancement (AECC): Professional English I	2	2
	Non Major Elective: Office Automation *	2	2
	Basic Tamil *		
	Advanced Tamil I*		
	Foundation Course FC – Problem Solving Techniques	2	2
		22	**30**

*PART-IV: SEC-1 / Basic Tamil / Advanced Tamil (Any one)

1. Students who have studied Tamil upto XII STD and also have taken Tamil in Part I shall take SEC-I.
2. Students who have not studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Basic Tamil** comprising of Two Courses (level will be at 6th Std.).
3. Students who have studied Tamil upto XII STD and have taken any Language other than Tamil in Part-I shall take **Advanced Tamil** comprising of Two Courses.

Semester-II

Part	List of Courses	Credit	Hours per week(L/T/P)
Part-I	Language –Tamil-II	3	4
Part-II	English-II	3	4
Part-III	C and C++ Programming lab	4	6
	Elective Course 2 - Generic (Any One) – Mathematics II	3	5
	Elective Course 2 - Generic (Any One) – Physics II	3	5
Part-IV	Non Major Elective: Fundamentals of Information Technology	2	2
	Ability Enhancement (AECC): Professional English II	2	2
	Skill Enhancement Course- I: HTML Lab	2	2
	Basic Tamil II*		
	Advanced Tamil II*		
		22	**30**

Second Year

Semester-III

Part	List of Courses	Credit	Hours per week(L/T/P)
Part-I	Language – Tamil – III	3	6
Part-II	English – III	3	6
Part-III	Data Structure	4	5
	Practical- Data Structure Lab	4	4
	Microprocessor and Microcontroller	4	4
Part-IV	Ability Enhancement (AECC): Personality Enrichment I	2	1
	Skill Enhancement Course - II : PHP Programming Lab	2	2
	Skill Enhancement Course - III : Web Design Lab	1	1
	Environmental Studies	-	1
		23	**30**

Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language – Tamil – IV	3	6
Part-II	English– IV	3	6
Part-III	Java Programming	4	4
	Java Programming Lab	4	3
	Operating System	4	4
Part-IV	Ability Enhancement (AECC): Personality Enrichment II	2	2
	Skill Enhancement Course - IV: Understanding Internet	2	2
	Skill Enhancement Course - V: Enterprise Resource Planning	2	2
	Environmental Studies	2	1
		26	**30**

Third Year
Semester-V

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Software Engineering	4	5
	Data Analytics using R	4	5
	Data Analytics using R Lab	4	5
	CC12 - Project with Viva Voce	4	5
	Elective Course – EC5 - Discipline Specific – (Any One) E-commerce/ Grid Computing / Big Data Analytics	3	4
	Elective Course – EC6 - Discipline Specific –(Any One) Information Security / Natural Language Processing/ Virtual and Augment Reality	3	4
Part-IV	Value Education	2	2
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	--
		26	**30**

Semester-VI

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-III	Computer Network	4	6
	.NET Programming	4	5
	.NET Programming Lab	4	5
	Elective Course – Discipline Specific – (Any One) RDBMS with PL/SQL/ IOT and its Applications/ Agile Project Management	3	5
	Elective Course -Discipline Specific – (Any One) Software Project Management / Biometric Technique/ Artificial Intelligence	3	5
Part-IV	Professional Competency Skill Enhancement Course Advanced Excel	2	4
Part -V	Extension Activity	1	--
		21	**30**

Semester -VII

Part	List of Courses	Credit	Hours per week (L/T/P)
Core – I	Advanced Software Engineering	4	5
Core – II	Python Programming	4	6
Core – III	Python Programming Lab	4	5
Elective – I	Design and Analysis of Algorithm / Human Computer Interaction / High Performance computing	3	5
Elective – II	Object oriented Analysis and Design / Parallel Computing / Text Mining	3	5
Ability Enhancement Course	Language and communications	2	2
Skill Enhancement	UML LAB	2	2
	Total	22	30

SEMESTER -VIII

Part	List of Courses	Credit	Hours per week (L/T/P)
Core - IV	Data Mining and warehousing	4	6
Core – V	Advanced Operating System	4	6
Core - VI	Web Technology and Advanced java	4	6
Elective – III	Software Testing / Computer Vision / Artificial Neural Network and Deep Learning /	3	4
Elective –IV	Multimedia and its Applications/ Theory of Computation / Embedded System	3	4
Ability Enhancement Course	Spoken and Presentation skill advanced level	2	2
Skill Enhancement	Web Technology and Advanced java Lab	2	2
	Total	22	30

SEMESTER -IX

Part	List of Courses	Credit	Hours per week (L/T/P)
Core - VII	Digital Image Processing	4	5
Core – VIII	Cloud Computing	4	5
Core – IX	Digital Image Processing Lab Using Python	4	5
Elective – V	Cryptography/ Distributed Database System / Fuzzy Logic	3	4
Elective - VI	Mobile Computing / Principle of Complier Design / Block chain Technology	3	4
Core Industry Module	Robotic Process Automation for Business	3	3
Ability Enhancement Course	Contemporary Awareness	2	2
Skill Enhancement	Cloud Computing Lab	2	2
Internship Industrial Activity		2	-
	Total	27	30

SEMESTER -X

Part	List of Courses	Credit	Hours per week (L/T/P)
Core – XI	Mobile Application Development	4	6
Core – XII	Mobile Application Development Lab	4	6
Core - X	Machine Learning	4	6
	Project work and Viva- Voce (200marks)	3	8
Ability Enhancement Course	Life and Managerial Skills	2	2
Skill Enhancement Course	Skill Enhancement Course - Professional Competency Skill – Quantitative Aptitude	2	2
	Extension Activity	1	-
	Total	20	30
Grand Total		91	

First Year

Semester I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	C and C++ Programming	CORE	6	-	-	-	4	6	25	75	100
Learning Objectives											
LO1	To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ programs.										
LO2	To practice the fundamental programming methodologies in the C/C++ programming language via laboratory experiences. Microsoft Visual Studio is the programming environment that will used.										
LO3	To code, document, test, and implement a well-structured, robust computer program using the C/C++ programming language.										
LO4	To write reusable modules (collections of functions).										
UNIT	**Contents**										**No. of Hours**
I	C fundamentals – character set – identifier and key works – data types – constants – variables – declarations – expressions – statements – arithmetic, unary, relational and logical, assignment and conditional operators – library functions – flow of control – control structures – switch, break and continue, go to statements – comma operator.										18
II	Functions – defining, accessing functions – functions prototypes – passing arguments – recursions – storage classes – multi file programs - Arrays –passing arrays to functions – multidimensional arrays – arrays and string – structures – passing structures to functions - Pointers – declarations – passing pointers to functions – operation in pointers – pointer and arrays – arrays of pointers – structures and pointers.										18
III	Principles of Object Oriented Programming (OOP) – Software Evaluation -- OOP Paradigm – Basic Concepts of OOP – Benefits of OOP – Applications of OOP. Classes and Objects – Constructors and Destructors -- Operator overloading - Type Conversions – Type Conversions – Type of Constructors – Function Overloading.										18

IV	Inheritance – Types of Inheritance – Virtual Functions and Polymorphism Constructors in inheritance – Mapping Console I/O operations.	18
V	Files – File Streams – File operations – File pointer – Error Handling during file operations – Command line arguments.	1
	Total	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming	PO1,PO2,PO3,PO6
CO2	Acquire knowledge about the object-oriented paradigm.	PO1,PO2,PO3,PO6
CO3	Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.	PO3,PO5,PO7
CO4	Use of inheritance, polymorphism and encapsulation concepts in object-oriented programming	PO3,PO4,PO5,PO7
CO5	Role of Functions involving the idea of modularity.	PO4,PO6,PO7

Text Book	
1	Gottfried B S – Programming with C – II Edition TMH Pub Co Ltd.
2	E.Balaguruswamy, 1995,Programming in ANSI C, TMH Publishing Company Ltd

Reference Books	
1.	Kanetkar Y – Let us C - BPB Publication.
2	E. Balagurusamy,1995,Object Oriented Programming with C++, Tata McGraw

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	3	2	2	2	3	2
CO2	3	3	3	3	2	3
CO3	3	3	3	1	3	3

CO4	3	3	3	3	2	1
CO5	3	3	3	2	1	3
Weightage of course contributed to each PSO	15	14	14	12	11	12

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	OFFICE AUTOMATION	NME	**2**	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	Understand the basics of computer systems and its components.
LO2	Understand and apply the basic concepts of a word processing package.
LO3	Understand and apply the basic concepts of electronic spreadsheet software.
LO4	Understand and apply the basic concepts of database management system.
LO5	Understand and create a presentation using PowerPoint tool.

UNIT	**Contents**	**No. of Hours**
I	Introductory concepts: Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems & its features: DOS– UNIX–Windows. Introduction to Programming Languages.	6
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets; SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.	6
III	**Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying; Charts–creating, formatting and printing,analysistables,preparationoffinancialstatements,introducti ontodataanalytics.	6
IV	**Database Concepts:** The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS–Access).	6
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition–Animation effects, audio inclusion, timers.	6
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	

CO1	Possess the knowledge on the basics of computers and its components	PO1,PO2,PO3,PO6
CO2	Gain knowledge on Creating Documents, spreadsheet and presentation.	PO1,PO2,PO3,PO6
CO3	Learn the concepts of Database and implement the Query in Database.	PO3,PO5,PO7
CO4	Demonstrate the understanding of different automation tools.	PO3,PO4,PO5,PO7
CO5	Utilize the automation tools for documentation, calculation and presentation purpose.	PO4,PO6,PO7

Text Book	
1	PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.
Reference Books	
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, "Microsoft 2003", Tata McGrawHill.
Web Resources	
1.	https://www.udemy.com/course/office-automation-certificate-course/
2.	https://www.javatpoint.com/automation-tools

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**14**	**14**	**15**	**15**	**15**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Problem Solving Techniques	FC	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	Familiarize with writing of algorithms, fundamentals of C and philosophy of problem solving.
LO2	Implement different programming constructs and decomposition of problems into functions.
LO3	Use data flow diagram, Pseudo code to implement solutions.
LO4	Define and use of arrays with simple applications
LO5	Understand about operating system and their uses

UNIT	Contents	No. Of. Hours
I	**Introduction:** History, characteristics and limitations of Computer. Hardware/Anatomy of Computer: CPU, Memory, Secondary storage devices, Input Devices and Output devices. Types of Computers: PC, Workstation, Minicomputer, Main frame and Supercomputer. Software: System software and Application software. **Programming Languages:** Machine language, Assembly language, High-level language,4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.	**6**
II	**Data:** Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC).**Structured Programming: Algorithm:** Features of good algorithm, Benefits and drawbacks of algorithm. **Flowcharts:** Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts.**Pseudocode:** Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. **Program design:** Modular Programming.	**6**
III	**Selection Structures:** Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. **Repetition Structures:** Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.	**6**
IV	**Data:** Numeric Data and Character Based Data. **Arrays:** One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.	**6**

V	**Data Flow Diagrams:** Definition, DFD symbols and types of DFDs. **Program Modules:** Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. **Files:** File Basics-Creating and reading a sequential file- Modifying Sequential Files.	**6**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Study the basic knowledge of Computers. Analyze the programming languages.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Study the data types and arithmetic operations. Know about the algorithms. Develop program using flow chart and pseudocode.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Determine the various operators. Explain about the structures. Illustrate the concept of Loops	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Study about Numeric data and character-based data. Analyze about Arrays.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Explain about DFD Illustrate program modules. Creating and reading Files	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1	**Stewart Venit,** "Introduction to Programming: Concepts and Design", Fourth Edition, 2010, Dream Tech Publishers.

Web Resources

1.	https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm
2.	http://www.nptel.iitm.ac.in/video.php?subjectId=106102067
3.	http://utubersity.com/?page_id=876

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	2	3	3	3	3
CO 4	3	3	2	3	3	3
CO 5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	14	14	15	15	14

S-Strong-3 M-Medium-2 L-Low-1

Semester II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	C and C++ Programming Lab	CORE	6	-	-	-	4	6	40	60	100

Learning Objectives	
LO1	To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ programs.
LO2	To practice the fundamental programming methodologies in the C/C++ programming language via laboratory experiences. Microsoft Visual Studio is the programming environment that will used.
LO3	To code, document, test, and implement a well-structured, robust computer program using the C/C++ programming language.

UNIT	**Contents**	**No. of Hours**
	1. Summation of series a. sin(x) b. cos(x) c. exp(x) 2. String manipulations a. Counting the number of vowels, consonants, words white spaces in a line of text andarray of lines. b. Reverse a string & check for palindrome c. Sub string detection and count d. Sub string removal e. Find and replacing substrings 3. Recursion a. GCD of two numbers b. Fibonacci sequence c. Tower of Honoi 4. Matrix manipulation a. Addition & subtraction	90

	b. Multiplication 5. Sorting and searching a. Insertion sort b. Bubble sort 6. Create a class Box containing length, breath and height. Include following methods in it: a) Calculate surface Area b) Calculate Volume c) Overload ++ operator d) Overload -- operator 7. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file. 8. Write a program to retrieve the student information from file created in previous question and print it in following format: Roll No. Name Marks 9. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respective information in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism). 10. Create a class Triangle. Include overloaded functions for calculating area. Overload assignment operator and equality operator.	
	Total	**90**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.	PO1, PO2, PO6
CO2	Acquire knowledge about the object-oriented paradigm.	PO2, PO3
CO3	Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.	PO1, PO3, PO5
CO4	Use of inheritance, polymorphism and encapsulation concepts in object-oriented programming	PO2, PO6
CO5	Role of Functions involving the idea of modularity.	PO1, PO3, PO6

Text Book	
1	Gottfried B S – Programming with C – II Edition TMH Pub Co Ltd.
2	E.Balaguruswamy, 1995,Programming in ANSI C, TMH Publishing Company Ltd
Reference Books	
1.	Kanetkar Y – Let us C - BPB Publication.
2	E. Balagurusamy,1995,Object Oriented Programming with C++, Tata McGraw

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**1**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**2**	**1**
CO5	**3**	**3**	**3**	**2**	**1**	**3**
Weightage of course contributed to each PSO	**15**	**14**	**14**	**12**	**11**	**12**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Inst. hours	Credits	Marks		
									CIA	External	Total
	Fundamentals of Information Technology	**NME**	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	Understand basic concepts and terminology of information technology.
LO2	Have a basic understanding of personal computers and their operation
LO3	Be able to identify data storage and its usage
LO4	Get great knowledge of software and its functionalities
LO5	Understand about operating system and their uses

UNIT	**Contents**	**No. Of. Hours**
I	**Introduction to Computers:** Introduction, Definition, .Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer	**6**
II	**Basic Computer Organization:** Role of I/O devices in a computer system. Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen, and Output Units: Monitors and its types. Printers: Impact Printers and its types. Non Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.	**6**
III	**Storage Fundamentals:** Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks. Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives	**6**
IV	**Software:** Software and its needs, Types of S/W. System Software: Operating System, Utility Programs Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w	**6**
V	**Operating System:** Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	**6**
	TOTAL HOURS	**30**

	Course Outcomes	**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Learn the basics of computer, Construct the structure of the required things in computer, learn how to use it.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop organizational structure using for the devices present currently under input	PO1, PO2,

	or output unit.	PO3, PO4, PO5, PO6
CO3	Concept of storing data in computer using two header namely RAM and ROM with different types of ROM with advancement in storage basis.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with different software, Write program in the software and applications of software.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of Operating system in information technology which really acts as a interpreter between software and hardware.	PO1, PO2, PO3, PO4, PO5, PO6

	Textbooks
1	Anoop Mathew, S. KavithaMurugeshan (2009), "Fundamental of Information Technology", Majestic Books.
2	Alexis Leon, Mathews Leon," Fundamental of Information Technology", 2nd Edition.
3	S. K Bansal, "Fundamental of Information Technology".
	Reference Books
1.	Bhardwaj Sushi lPuneet Kumar, "Fundamental of Information Technology"
2.	GG WILKINSON, "Fundamentals of Information Technology", Wiley-Blackwell
3.	A Ravichandran , "Fundamentals of Information Technology", Khanna Book Publishing
	Web Resources
1.	https://testbook.com/learn/computer-fundamentals
2.	https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html
3.	https://www.javatpoint.com/computer-fundamentals-tutorial
4.	https://www.tutorialspoint.com/computer_fundamentals/index.htm
5.	https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3
CO 4	3	3	3	3	2	3
CO 5	3	3	2	3	3	2
Weightage of course contributed to each PSO	15	15	14	15	14	14

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	HTML LAB	Skill Enha. Course (SEC)	-	-	2		2	40	60	100

Learning Objectives	
LO1	Insert a graphic within a web page.
LO2	Create a link within a web page.
LO3	Create a table within a web page.
LO4	Insert heading levels within a web page.
LO5	Insert ordered and unordered lists within a web page. Create a web page.

UNIT	Contents	No. Of. Hours
	1. Write a HTML program to display "Happy Birthday" Wishes 2. Write a HTML program to demonstrate Text Formatting Tags 3. Write a HTML program to create a Home page having three links and Create separate web pages for the three links 4. Write a HTML program to demonstrate Ordered List 5. Write a HTML program to demonstrate Unordered List 6. Write a HTML program to demonstrate Definition List 7. Write a HTML code to create a Time Table for your class 8. Write a HTML code to illustrate Image Mapping 9. Write a HTML program to add Multimedia to your page 10. Write an HTML program to create a Registration Form	**30**
	TOTAL HOURS	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Knows the basic concept in HTML Concept of resources in HTML	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows Design concept. Concept of Meta Data Understand the concept of save the files.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the page formatting. Concept of list	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Creating Links. Know the concept of creating link to email address	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Concept of adding images Understand the table creation.	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks	
1	"Mastering HTML5 and CSS3 Made Easy", TeachUComp Inc., 2014.
2	**Thomas Michaud, "Foundations of Web Design: Introduction to HTML & CSS"**

Web Resources	
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Second Year

Semester III

Title of the Course / Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC3	DATA STRUCTURE	Core	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph structures and application of graphs
LO5	To understand various sorting and searching

UNIT	Contents	No. of Hours
I	Abstract Data Types (ADTs)- List ADT-array-based implementation-linked list implementation singly linked lists-circular linked lists-doubly-linked lists-applications of lists-Polynomial Manipulation- All operations-Insertion-Deletion-Merge-Traversal	15
II	Stack ADT-Operations- Applications- Evaluating arithmetic expressions – Conversion of infix to postfix expression-Queue ADT-Operations-Circular Queue- Priority Queue- DeQueue applications of queues.	15
III	Tree ADT-tree traversals-Binary Tree ADT-expression trees-applications of trees-binary search tree ADT- Threaded Binary Trees-AVL Trees- B-Tree- B+ Tree – Heap-Applications of heap.	15
IV	Definition- Representation of Graph- Types of graph-Breadth first traversal – Depth first traversal-Topological sort- Bi-connectivity – Cut vertex- Euler circuits-Applications of graphs.	15
V	Searching- Linear search-Binary search-Sorting-Bubble sort-Selection sort-Insertion sort-Shell sort-Radix sort-Hashing-Hash functions-Separate chaining- Open Addressing-Rehashing Extendible Hashing	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO6
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO2

CO3	Describe the hash function and concepts of collision and its resolution methods	PO2,PO4
CO4	Solve problem involving graphs, trees and heaps	PO4,PO6
CO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO5,PO6

Text Book	
1	1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2	ReemaThareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition

Reference Books	
1.	Thomas H.Cormen, Chales E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition.
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003

Web Resources	
1.	https://www.programiz.com/dsa
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	3	3
CO 3	3	3	3	2	3	2
CO 4	3	2	3	2	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	14	13	13	15	14

S-Strong-3 M-Medium-2 L-Low-1

Title of the Course/ Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC4	**DATA STRUCTURE Lab**	Core	-	-	4	-	4	4	40	60	100

Learning Objectives	
LO1	To understand the concepts of ADTs
LO2	To learn linear data structures-lists, stacks, queues
LO3	To learn Tree structures and application of trees
LO4	To learn graph strutures and and application of graphs
LO5	To understand various sorting and searching

Sl. No	**Contents**	**No. of Hours**
1.	Write a program to implement the List ADT using arrays and linked lists.	**60**
2.	Write a programs to implement the following using a singly linked list. • Stack ADT • Queue ADT	
3.	Write a program that reads an infix expression, converts the expression to postfix form and then evaluates the postfix expression (use stack ADT).	
4.	Write a program to implement priority queue ADT.	
5.	Write a program to perform the following operations: • Insert an element into a binary search tree. • Delete an element from a binary search tree. • Search for a key element in a binary search tree.	
6.	Write a program to perform the following operations • Insertion into an AVL-tree • Deletion from an AVL-tree	
7.	Write a programs for the implementation of BFS and DFS for a given graph.	

8	Write a programs for implementing the following searching methods: • Linear search • Binary search.	
9.	Write a programs for implementing the following sorting methods: • Bubble sort • Selection sort • Insertion sort • Radix sort.	
	Total	**60**

Course Outcomes		**Programmem Outcome**
CO	On completion of this course, students will	
1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation	PO1,PO4,PO5
2	Understand basic data structures such as arrays, linked lists, stacks and queues	PO1, PO4,PO6
3	Describe the hash function and concepts of collision and its resolution methods	PO1,PO3,PO6
4	Solve problem involving graphs, trees and heaps	PO3,PO4
5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data	PO1,PO5,PO6

Text Book	
1	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education 2014, 4th Edition.
2	Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition
Reference Books	
1	Thomas H.Cormen, Chales E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", McGraw Hill 2009, 3rd Edition
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education 2003
Web Resources	
1.	https://www.programiz.com/dsa
2.	https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO 1	3	3	3	3	3	3
CO 2	3	3	1	3	2	3
CO 3	3	3	3	3	2	3

CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
Weightage of course contributed to each PSO	15	15	13	15	13	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC5	**Microprocessor and Microcontroller**	Core	4	-	-	-	4	4	25	75	100

Learning Objectives	
LO1	To introduce the internal organization of Intel 8085 Microprocessor.
LO2	To know about various instruction sets and classifictions
LO3	To enable the students to write assembly language programs using 8085.
LO4	To interface the peripheral devices to 8085 using Interrrupt controller and DMA interface.
LO5	To provide real-life applications using microcontroller.

UNIT	Contents	No. of Hours
I	Digital Computers - Microcomputer Organization-Computer languages –Microprocessor Architecture and its operations – Microprocessor initiated operations and 8085 Bus organization – Internal Data operations and 8085 registers - Peripheral or External initiated operations.	12
II	8085 Microprocessor – Pinout and Signals – Functional block diagram - 8085 Instruction Set and Classifications.	12
III	BCD to Binary and Binary to BCD conversions - ASCII to BCD and BCD to ASCII conversions - Binary to ASCII and ASCII to Binary conversions. BCD Arithmetic - BCD addition and Subtraction - Multibyte Addition and Subtraction - Multiplication and Division.	12
IV	The 8085 Interrupts – RIM AND SIM instructions-8259 Programmable Interrupt Controller-Direct Memory Access (DMA) and 8257 DMA controller.	12
V	Introduction to Microcontroller - Microcontroller Vs Microprocessor - 8051 Microcontroller architecture - 8051 pin description. Timers and Counters – Operating Modes- Control Registers. Interrupts – Interrupts in 8051 - Interrupts Control Register – Execution of interrupt.	12

	Total	**60**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Remember the Basic binary codes and their conversions. Binary concepts are used in Microprocessor programming and provide a good understanding of the architecture of 8085o introduce the internal organization of Intel 8085 Microprocessor.	PO1
CO2	Understanding the 8085 instruction set and their classifications, enables the students to write the programs easily on their own using different logic.	PO1,PO2
CO3	Applying different types of instructions to convert binary codes and analyzing the outcome. The instruction set is applied to develop programs on multibyte arithmetic operations.	PO4,PO6
CO4	Analyze how peripheral devices are connected to 8085 using Interrupts and DMA controller.	PO4,PO5,PO6
CO5	An exposure to create real time applications using microcontroller.	PO3,PO6

Text Book	
1	R. S. Gaonkar- "Microprocessor Architecture- Programming and Applications with 8085"- 5th Edition- Penram International Publications, 2009. [For unit I to unit IV]
2	Soumitra Kumar Mandal -“Microprocessors and Microcontrollers – Architectures, Programming and Interfacing using 8085, 8086, 8051”, Tata McGraw Hill Education Private Limited. [For unit V].

Reference Books	
1.	Mathur- “Introduction to Microprocessor”- 3rd Edition- Tata McGraw-Hill -1993.
2.	Raj Kamal - “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.
3.	Krishna Kant, “Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096”, PHI, 2008

Web Resources	
1.	E-content from open source libraries

2.	https://www.bing.com/, https://theopennotes.in/

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	2	2
CO2	3	3	3	2	3	2
CO3	3	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	3	2	3	2
Weightage of course contributed to each PSO	15	15	14	12	14	10

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	PHP PROGRAMMING LAB	Skill Enha.Course (SEC)	2	-	-	-	2	2	40	60	100

Learn ing Objectives		
LO1	To provide the necessary knowledge on basics of PHP.	
LO2	To design and develop dynamic, database-driven web applications using PHP version.	
LO3	To get an experience on various web application development techniques.	
LO4	To learn the necessary concepts for working with the files using PHP.	
LO5	To get a knowledge on OOPS with PHP.	
UNIT	**Contents**	**No. of Hours**
	1. Write a PHP program which adds up columns and rows of given table 2. Write a PHP program to compute the sum of first n given prime numbers 3. Write a PHP program to validate an email address 4. Write a PHP program to convert a number written in words to digit. 5. Write a PHP script to delay the program execution for the given number of seconds. 6. Write a PHP script, which changes the colour of the first character of a	30

	word 7. Write a PHP program to generate a multiplication table of a number. 8. Write a PHP program to calculate the Factorial of a number. 9. Write a PHP script to read a file, reverse its contents, and write the result back to a new file 10. Write a PHP script to look through the current directory and rename all the files with extension .txt to extension .xtx	
	Total	**30**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Write PHP scripts to handle HTML forms	PO1,PO4,PO6
CO2	Write regular expressions including modifiers, operators, and meta characters.	PO2,PO5,PO7.
CO3	Create PHP Program using the concept of array.	PO3,PO4,PO5.
CO4	Create PHP programs that use various PHP library functions	PO2,PO3,PO5
CO5	Manipulate files and directories.	PO3,PO5,PO6.

Text Book	
1	Head First PHP & MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.
2	The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes
Reference Books	
1.	PHP: The Complete Reference-Steven Holzner.
2.	DT Editorial Services (Author), "*HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)*", Paperback 2016, 2nd Edition.
Web Resources	
1.	Opensource digital libraries: PHP Programming
2.	https://www.w3schools.com/php/default.asp

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
	WEB DESIGNING LAB	Skill Enha. Course (SEC)	-	-	1	-	1		40	60	100

Learning Objectives	
LO1	Understand the basics of HTML and its components
LO2	To study about the Graphics in HTML
LO3	Understand and apply the concepts of CSS
LO4	Understand the concept of JavaScript
LO5	Understand the table concept

UNIT	Details	No. of Hours
	1. Write a HTML program to use heading tags 2. Write a HTML program to use external and internal links in web page 3. Write a HTML program to insert image in a web page and use the image properties 4. Write a HTML program to format text using CSS 5. Write a JavaScript program to print the contents of the current window. 6. Write a JavaScript program to get the current date. 7. Write a JavaScript program to convert temperatures to and from Celsius, Fahrenheit. 8. Write a JavaScript exercise to create a variable using a user-defined name. 9. Write a JavaScript program to calculate multiplication and division of two numbers (input from user) 10. Write a JavaScript program to set the background color of a paragraph. 11. Write a JavaScript function to get the values of First name and Last name and print the result. 12. Write a JavaScript program to highlight the bold words of the following paragraph, on mouse over a certain link. 13. Write a JavaScript function that creates a table by accepting the number of rows & columns from the user. 14. Write a JavaScript program to get the width and height of the window (any time the window is resized)	
	Total	**15**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	Develop working knowledge of HTML	PO1, PO3, PO6
CO2	Ability to Develop and publish Web pages using Hypertext Markup Language (HTML).	PO1,PO2,PO3,PO6

CO3	Ability to optimize page styles and layout with Cascading Style Sheets (CSS).	PO3, PO5
CO4	Ability to develop a java script	PO1, PO2, PO3, PO7
CO5	An ability to develop web application using javascript.	P02, PO6, PO7
Text Book		
1	Pankaj Sharma, "Web Technology", SkKataria& Sons Bangalore 2011.	
2	Mike Mcgrath, "Java Script", Dream Tech Press 2006, 1st Edition.	
3	Achyut S Godbole&AtulKahate, "Web Technologies", 2002, 2nd Edition.	
Reference Books		
1.	Laura Lemay, RafeColburn, Jennifer Kyrnin, "Mastering HTML, CSS &Javascript Web Publishing", 2016.	
2.	DT Editorial Services (Author), "HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)", Paperback 2016, 2nd Edition.	
Web Resources		
1.	NPTEL & MOOC courses titled Web Design and Development.	
2.	https://www.geeksforgeeks.org	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributedto each PSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Semester -IV

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	Ext	Total
CC7	**Java Programming**	Core	4	-	-	-	4	4	25	75	100

Learning Objectives	
LO1	To provide fundamental knowledge of object-oriented programming
LO2	To equip the student with programming knowledge in Core Java from the basics up.
LO3	To enable the students to use AWT controls, Event Handling and Swing for GUI.
LO4	To provide fundamental knowledge of object-oriented programming.
LO5	To equip the student with programming knowledge in Core Java from the basics up.

UNIT	**Contents**	**No. of Hours**
I	**Introduction:** Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture – Datatypes - Variables - Scope and life timeofvariables - arrays - operators - controlstatements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - StaticMethodStringandStringBufferClasses.	12
II	**Inheritance**: Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. **Packages**:Definition-AccessProtection -ImportingPackages. **Interfaces**:Definition–Implementation–Extending Interfaces. **Exception Handling**: *try – catch- throw - throws – finally* – Built-inexceptions - Creating own Exception classes.	12
III	**Multithreaded Programming**: Thread Class - Runnable interface –Synchronization–Using synchronizedmethods– Using synchronized statement- InterthreadCommunication –Deadlock. **I/O Streams:** Concepts of streams - Stream classes- Byte and	12

	Character stream - Reading console Input and Writing Console output - File Handling.	
IV	**AWT Controls:** The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers. **Event Handling:** Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes	12
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel,JTextField - JTextArea - JList - JComboBox - JScrollPane.	12
	Total	**60**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java.	PO1, PO2, PO6
CO2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3
CO3	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
CO4	Implement AWT and Event handling.	PO2, PO6
CO5	Use Swing to create GUI.	PO1, PO3, PO6

Text Books:

1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999

References :

1.	Head First Java, O'Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010

Web Resources	
1.	https://javabeginnerstutorial.com/core-java-tutorial
2.	http://docs.oracle.com/javase/tutorial/
3.	https://www.coursera.org/

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**3**	**3**	**2**	**2**	**3**
CO3	**2**	**2**	**1**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**1**
Weightage of course contributed to each PSO	**14**	**14**	**13**	**14**	**14**	**11**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Java Programming Lab	Core	-	-	3	-	4	3	40	60	100
Learning Objectives											
LO1	To provide fundamental knowledge of object-oriented programming.										
LO2	To equip the student with programming knowledge in Core Java from the basics up.										
LO3	To enable the students to know about Event Handling .										
LO4	To enable the students to use String Concepts.										
LO5	To equip the student with programming knowledge in to create GUI using AWT controls.										
EXCERCISE	**Details**										
1	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer										
2	Write a Java program to multiply two given matrices.										
3	Write a Java program that displays the number of characters, lines and words in a text										
4	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.										
5	Write a program to do String Manipulation using CharacterArray and perform the following string operations: a. String length b. Finding a character at a particular position c. Concatenating two strings										
6	Write a program to perform the following string operations using String class: a. String Concatenation b. Search a substring c. To extract substring from given string										
7	Write a program to perform string operations using String Buffer										

	class: a. Length of a string b. Reverse a string c. Delete a substring from the given string	45
8	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.	
9	Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread2.	
10	Write a program to demonstrate the use of following exceptions. a. Arithmetic Exception b. Number Format Exception c. ArrayIndexOutofBoundException d. NegativeArraySizeException	
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes	
12	Write a program to accept a text and change its size and font. Include bold italic options. Use frames and controls.	
13	Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).	
14	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions	

	like divide by zero.	
15	Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.	
	Total	**45**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java.	PO1
2	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO1, PO2
3	Implement multi-threading and I/O Streams of Core Java	PO4, PO6
4	Implement AWT and Event handling.	PO4, PO5, PO6
5	Use Swing to create GUI.	PO3, PO6

Text Book	
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
2.	Gary Cornell, *Core Java 2 Volume I – Fundamentals,* Addison Wesley, 1999.
Reference Books	
1.	Head First Java, O’Rielly Publications,
2.	Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.
Web Resources	
1.	https://www.w3schools.com/java/
2.	http://java.sun.com
3.	http://www.afu.com/javafaq.html

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	2
CO2	3	3	3	2	2	3
CO3	2	2	1	3	3	3
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	14	14	13	14	14	12

S
S
-

Strong M-Medium L-Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
	Operating Systems	Core	4	-	-	-	4	4	25	75	100

	Course Objective
LO1	Under standing the design of the Operating System
LO2	Imparting knowledge on CPU scheduling, Process and Memory Management.
LO3	To code specialized programs for managing over all resources and operations of the computer.
LO4	To study about the concept to Job and processor scheduling
LO5	To learn about to concept of memory organization and multi programming

UNIT	Details	No.of Hours

	Introduction: operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation.**Process concepts:** definition of process, process states-Life cycle of a process, process management-process state transitions, process control block(PCB), process operations , suspend and resume, context switching, Interrupts-Interrupt processing, interrupt classes,Inter process communication-signals,message passing.	12
II	**Asynchronous concurrent processes:**mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson‘s algorithm, software solutions to the mutual Exclusion Problem-,n-thread mutual exclusion-Lamports Bakery Algorithm.Semaphores–Mutual exclusion with Semaphores, thread synchronization with semaphores, Counting semaphores, implementing semaphores. **Concurrent programming:** monitors, message passing	12
III	**Deadlock and indefinite postponement:** Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra‘s Banker‘s algorithm, deadlock detection, deadlock recovery.	12
IV	**Job and processor scheduling:** scheduling levels, scheduling objectives, scheduling criteria, preemptivevs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms-FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling.	12
V	**Real Memory organization and Management :**Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation,single user contiguous memory allocation, fixed partition multi programming, variable partition multi programming, Memory swapping **Virtual Memory organization:** virtual memory basic concepts, multi level storageorganization, block mapping, paging basic concepts, segmentation, and paging/segmentation systems. **Virtual Memory Management:**Demand Paging, Page replacement strategies	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Define the fundamentals of OS and identify the concepts relevant to process, process life cycle, Scheduling Algorithms, Deadlock and Memory management	PO1
2	Know the critical analysis of process involving various algorithms, an exposure to threads and semaphores	PO1,PO2
3	Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock..	PO4,PO6
4	Have complete knowledge of Scheduling Algorithms and its types.	PO4,PO5,PO6
5	Under stand memory organization and management	PO3
Text Book		
1	H.M.Deitel, Operating Systems, Third Edition,Pearson Education Asia,2011	
Reference Books		
1.	William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hallof India, 2012.	
2.	A.Silberschatz, and P.B. Galvin., OperatingSystems Concepts, Nineth Edition, John Wiley & Sons (ASIA) Pte Ltd., 2012	

Mapping with Programme Outcomes:

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**-**	**1**	**2**	**-**	**1**
CO2	**2**	**3**	**1**	**2**	**-**	**1**
CO3	**3**	**2**	**-**	**3**	**-**	**1**
CO4	**1**	**3**	**1**	**1**	**3**	**2**
CO5	**3**	**-**	**1**	**3**	**2**	**1**
Weightage of course contributed to each PSO	12	8	4	11	5	6

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	UNDERSTANDING INTERNET	Skill Enha. Course (SEC)	2	-	-		2	25	75	100

Learning Objectives	
LO1	Knowledge of Internet medium
LO2	Internet as a mass medium
LO3	Features of Internet Technology,
LO4	Internet as source of infotainment
LO5	Study of internet audiences and about cyber crime

UNIT	Contents	No. Of. Hours
I	The emergence of internet as a mass medium–the world of 'world wide web'.	**6**
II	Features of internet as a technology.	**6**
III	Internet as a source of infotainment – classification based on content and style.	**6**
IV	Demographic and psychographic descriptions of internet 'audiences' – effect of internet on the values and life-styles.	**6**
V	Present issues such as cyber crime and future possibilities.	**6**
	TOTAL HOURS	**30**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Knows the basic concept in internet Concept of mass medium and world wide web	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Knows the concept of internet as a technology.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Understand the concept of infotainment and classification based on content and style	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Can be able to know about Demographic and psychographic description of internet	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand the concept of cyber crime and future possibilities	PO1, PO2, PO3, PO4, PO5, PO6

Textbooks

1. 01. Barnouw, E and Krishnaswamy S [1990] Indian Film. New York, OUP.
2. Kumar, Keval [1999] Mass Communication in India. Mumbai, Jaico.
3. Srivastava, K M [1992] Media Issues. Sterling Publishers Pvt Ltd.

Reference Book

1. Acharya, R N [1987] Television in India. Manas Publications, New Delhi.
2. Barnouw, E [1974] Documentary – A History of Nonfiction. Oxford, OUP
3. Luthra, H R [1986] Indian Broadcasting. Ministry of I& B, New Delhi.

4	Vasudev, Aruna [1986] The New Indian Cinema. Macmillan India, New Delhi.

Web Resources	
1.	https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf
2.	https://www.w3schools.com/html/default.asp

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	3
CO 2	3	3	2	3	3	3
CO 3	2	3	3	3	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	2	3	3
Weightage of course contributed to each PSO	14	15	14	14	15	15

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Enterprise Resource Planning	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives	
LO1	To understand the basic concepts, Evolution and Benefits of ERP.
LO2	To know the need and Role of ERP in logical and Physical Integration.
LO3	Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management
LO4	To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth
LO5	To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills

UNIT	Details	No. of Hours
I	ERP Introduction, Benefits, Origin, Evolution and Structure:	6

	Conceptual Model of ERP, the Evolution of ERP, the Structure of ERP, Components and needs of ERP, ERP Vendors; Benefits & Limitations of ERP Packages.	
II	Need to focus on Enterprise Integration/ERP; Information mapping; Role of common shared Enterprise database; System Integration, Logical vs. Physical System Integration, Benefits & limitations of System Integration, ERP's Role in Logical and Physical Integration. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing (OLAP), Product Life Cycle Man-agement (PLM), LAP, Supply chain Management.	6
III	ERP Marketplace and Marketplace Dynamics: Market Overview, Marketplace Dynamics, the Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. Cloud and Open Source, Quality Management, Material Management, Financial Module, CRM and Case Study.	6
IV	ERP Implementation Basics, , ERP implementation Strategy, ERP Implementation Life Cycle ,Pre- Implementation task,Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees.	6
V	ERP & E-Commerce, Future Directives- in ERP, ERP and Internet, Critical success and failure factors, Integrating ERP into or-ganizational culture. Using ERP tool: either SAP or ORACLE format to case study.	6
	Total	**30**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Understand the basic concepts of ERP.	PO1, PO2, PO6
CO2	Identify different technologies used in ERP	PO2, PO3, PO4
CO3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules	PO1, PO3, PO6
CO4	Discuss the benefits of ERP	PO2, PO6
CO5	Apply different tools used in ERP	PO1, PO3, PO5

Reference Text :

1. Enterprise Resource Planning – Alexis Leon, Tata McGraw Hill.

References :

1. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
2. Enterprise Resource Planning – Ravi Shankar & S. Jaiswal , Galgotia

Web Resources

1. https://www.tutorialspoint.com/management_concepts/enterprise_resource_planning.htm
2. https://www.saponlinetutorials.com/what-is-erp-systems-enterprise-resource-planning/
3. https://www.guru99.com/erp-full-form.html
4. https://www.oracle.com/in/erp/what-is-erp/

Mapping with Programe Outcomes:

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**3**	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**3**
Weightage of course contributed to each PSO	**15**	**15**	**14**	**12**	**13**	**11**

Third Year
Semester – V

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC9	**Software Engineering**	Core	5	-	-	-	4	5	25	75	100

Learning Objectives	
LO1	Gain basic knowledge of analysis and design of systems
LO2	Ability to apply software engineering principles and techniques
LO3	Model a reliable and cost-effective software system
LO4	Ability to design an effective model of the system
LO5	Perform Testing at various levels and produce an efficient system.

Course Objectives

UNIT	Contents	No. of Hours
I	**Introduction**: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering. **Software Life Cycle Models**: Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.	15
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS) **Software Design**: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design	15

III	**Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.**User-Interface design:** Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.	15
IV	**Coding and Testing:** Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.**Software Reliability and Quality Management:** Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.	15
V	**Computer Aided Software Engineering:** CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment. **Software Maintenance:** Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost.	15
	Total	**75**

Course Outcomes

Course Outcomes	On completion of this course, students will;	
CO1	Gain basic knowledge of analysis and design of systems	PO1
CO2	Ability to apply software engineering principles and techniques	PO1, PO2
CO3	Model a reliable and cost-effective software system	PO4, PO6
CO4	Ability to design an effective model of the system	PO4, PO5, PO6
CO5	Perform Testing at various levels and produce an efficient	PO3, PO6

	system.	
Text Books		
1.	Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018	
References Books		
1.	Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997	
2.	Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.	
3.	James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.	

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**
Weightage of course contribute d to each PO/PSO	**15**	**13**	**14**	**10**	**10**	**11**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Data analytics using R	Core	5	-	-	-	4	5	25	75	100
Course Objective											
C1	To understand the problem solving approaches										
C2	To learn the basic programming constructs in R Programming										
C3	To learn the basic programming constructs in R Programming										
C4	To use R Programming data structures - lists, tuples, and dictionaries.										
C5	To do input/output with files in R Programming.										

UNIT	Contents	No. of Hours
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value -Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — MapReduce and YARN — Map Reduce Programming Model	15
II	CONTROL STRUCTURES AND VECTORS -Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector using subscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations	15
III	LISTS- Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, Data Frames, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations	15

IV	FACTORS AND TABLES - Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Sub table, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions R PROGRAMMING .	15
V	OBJECT-ORIENTED PROGRAMMING S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Function on an S Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO3
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO2, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO5, PO6

Text Book	
1	Roger D. Peng," R Programming for Data Science ", 2012
2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011
Reference Books	
1.	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.	Venables ,W.N.,andRipley,"S programming", Springer, 2000.
Web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightageofcoursecontributedtoeach PSO	14	13	14	14	14	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Data analytics using R Lab	Core	-	-	5	-	4	5	40	60	100
Course Objective											
C1	To understand the problem solving approaches										
C2	To learn the basic programming constructs in R Programming										
C3	To practice various computing strategies for R Programming -based solutions to real world problems										
C4	To use R Programming data structures - lists, tuples, and dictionaries.										
C5	To do input/output with files in R Programming.										
Sl. No	**Contents**										
1.	Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.										
2.	Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.										
3.	Write a program to find list of even numbers from 1 to n using R-Loops.										
4.	Create a function to print squares of numbers in sequence.										

5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	**75**
6.	Implement different String Manipulation functions in R.	
7.	Implement different data structures in R (Vectors, Lists, Data Frames)	
8	Write a program to read a csv file and analyze the data in the file in R.	
9	Create pie chart and bar chart using R.	
10	10. Create a data set and do statistical analysis on the data using R.	
11	Program to find factorial of the given number using recursive function	
12	Write a R program to count the number of even and odd numbers from array of N numbers.	
	Total	**75**

Course Outcomes		**Programe Outcome**
CO	On completion of this course, students will	
1	Acquire programming skills in core R Programming	PO1,PO4,PO5
2	Acquire Object-oriented programming skills in R Programming.	PO1, PO4,PO6
3	Develop the skill of designing graphical-user interfaces (GUI) in R Programming	PO1,PO3,PO6
4	Acquire R Programming skills to move into specific branches	PO3,PO4
5		PO1,PO5,PO6

Text Book	
1	Roger D. Peng," R Programming for Data Science ", 2012
2	Norman Matloff,"The Art of R Programming- A Tour of Statistical Software Design", 2011
Reference Books	
1	Garrett Grolemund, Hadley Wickham,"Hands-On Programming with R: Write Your Own Functions and Simulations" , 1st Edition, 2014
2.	Venables ,W.N.,andRipley,"S programming", Springer, 2000.
Web Resources	
1.	https://www.simplilearn.com

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3
CO2	3	3	2	3	2	2
CO3	3	2	3	3	3	2
CO4	3	2	3	2	3	3
CO5	2	3	3	3	3	3
Weightageofcoursecontributedtoeach PSO	14	13	14	14	14	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	E-COMMERCE	Elective	4	-	-	-	3	4	25	75	100
Course Objective											
C1	To provide an introduction to information systems for business and management.										
C2	To familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems										
UNIT	**Contents**										**No. of Hours**
I	**E-COMMERCE AND ITS TECHNOLOGICAL ASPECTS:** Overview of developments in information technology and defining e-commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.										12
II	**CONSUMER ORIENTED E COMMERCE:** E-Retailing: Traditional retailing and e retailing, Benefits of e retailing, Key success factors, Models of e retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, matchmaking services, Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce										12

III	**ELECTRONIC DATA INTERCHANGE**: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.	12
IV	**SECURITY IN E COMMERCE:** Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server. Issues in E Commerce Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.	12
V	**Issues in E Commerce** Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Understand the basic concepts and technologies used in the field of management information systems	PO1
2	Have the knowledge of the different types of management information systems	PO1, PO3
3	Understand the processes of developing and implementing information system	PO2, PO6
4	Be aware of the ethical, social, and security issues of information system	PO4, PO5, PO6
5	Design an E-commerce model for retail business with electronic data interchange and security issues.	PO5, PO6

Text Book	
1	Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
2	RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.
3	Efraim Turban, Jae Lee, David King, H.Michael Chung, “Electronic Commerce–A ManagerialPerspective", Addison-Wesley.
Reference Books	
1.	Elias M Award, “Electronic Commerce from Vision to Fulfilment”, 3rd Edition, PHI
2.	Judy Strauss, Adel El-Ansary, Raymond Frost, “E-Marketing”, 3RDEdition, Pearson Education.

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**1**	**2**
CO2	**2**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**-**	**1**
CO4	**3**	**-**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	2
Weightage of course Contributed to each PSO	12	9	8	8	8	9

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
	Grid Computing	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
LO1	To learn the basic construction and application of Grid computing.
LO2	To learn grid computing organization and their Role.
LO3	To learn Grid Computing Anotomy.
LO4	To learn Grid Computing road map.
LO5	To learn various type of Grid Architecture.

UNIT	Details	No. of Hours
I	Introduction: Early Grid Activity, Current Grid Activity, Overview of Grid Business areas, Grid Applications, Grid Infrastructures.	12
II	Grid Computing organization and their Roles: Organizations Developing Grid Standards, and Best Practice Guidelines, Global Grid Forum (GCF), #Organization Developing Grid Computing Toolkits and Framework#, Organization and building and using grid based solutions to solve computing, commercial organization building and Grid Based solutions.	12
III	Grid Computing Anatomy: The Grid Problem, The conceptual of virtual organizations, # Grid Architecture # and relationship to other distributed technology.	12
IV	The Grid Computing Road Map: Autonomic computing, Business on demand and infrastructure virtualization, Service-Oriented Architecture and Grid, #Semantic Grids#.	12
V	Merging the Grid services Architecture with the Web Services Architecture: Service-Oriented Architecture, Web Service Architecture, #XML messages and Enveloping#, Service message description Mechanisms, Relationship between Web Services and Grid Services, Web services Interoperability and the role of the WS-I Organization.	12
	Total	**60**

CourseOutcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	To understand the basic elements and concepts of Grid computing.	PO1

2	To understand the concepts of Anotomy of Grid Computing.	PO1,PO2
3	To understand the concept of service oriented architecture.	PO4,PO6
4	To Gain knowledge on grid and web service architecture.	PO4,PO5,PO6
5	To understand the concepts of Anotomy of Grid Computing.	PO3
TextBook		
1	Joshy Joseph and Craig Fellenstein, Grid computing, Pearson / IBM Press, PTR, 2004.	
ReferenceBooks		
1.	Ahmer Abbas and Graig computing, A Practical Guide to technology and applications, Charles River Media, 2003.	
WebResources		
1.	https://en.wikipedia.org/wiki/Grid_computing	
2.	https://link.springer.com/chapter/10.1007/978-1-84882-409-6_4	
3.	https://www.redbooks.ibm.com/redbooks/pdfs/sg246778.pdf	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**1**	**2**
CO2	**2**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**-**	**1**
CO4	**3**	**-**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	2
Weightage of course Contributed to each PSO	12	9	8	8	8	9

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Big Data Analytics	Elective	4	-	-	-	3	4	25	75	100

Course Objective	
C1	Understand the Big Data Platform and its Use cases, Map Reduce Jobs
C2	To identify and understand the basics of cluster and decision tree
C3	To study about the Association Rules,Recommendation System
C4	To learn about the concept of stream
C5	Understand the concepts of NoSQL Databases

UNIT	Contents	No. of Hours
I	Evolution of Big data — Best Practices for Big data Analytics — Big data characteristics — Validating — The Promotion of the Value of Big Data — Big Data Use Cases- Characteristics of Big Data Applications — Perception and Quantification of Value - Understanding Big Data Storage — A General Overview of High-Performance Architecture — HDFS — Map Reduce and YARN — Map Reduce Programming Model	12
II	Advanced Analytical Theory and Methods: Overview of Clustering — K-means — Use Cases — Overview of the Method — Determining the Number of Clusters — Diagnostics — Reasons to Choose and Cautions .- Classification: Decision Trees — Overview of a Decision Tree — The General Algorithm — Decision Tree Algorithms — Evaluating a Decision Tree — Decision Trees in R — Naïve Bayes — Bayes Theorem — Naïve Bayes Classifier.	12
III	Advanced Analytical Theory and Methods: Association Rules — Overview — Apriori Algorithm — Evaluation of Candidate Rules — Applications of Association Rules — Finding Association& finding similarity — Recommendation System: Collaborative Recommendation- Content Based Recommendation — Knowledge Based Recommendation- Hybrid Recommendation Approaches.	12

IV	Introduction to Streams Concepts — Stream Data Model and Architecture — Stream Computing, Sampling Data in a Stream — Filtering Streams — Counting Distinct Elements in a Stream — Estimating moments — Counting oneness in a Window — Decaying Window — Real time Analytics Platform(RTAP) applications — Case Studies — Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics	12
V	NoSQL Databases : Schema-less Models : Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores — Tabular Stores — Object Data Stores — Graph Databases Hive — Sharding — Hbase — Analyzing big data with twitter — Big data for E-Commerce Big data for blogs — Review of Basic Data Analytic Methods using R.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data	PO4, PO5
4	Perform analytics on data streams.	PO3, PO5, PO6
5	Learn No SQL databases and management.	PO3, PO4

Text Book

1	Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

Reference Books

1.	David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/El sevier Publishers, 2013
2.	EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.

Web Resources

1.	https://www.simplilearn.com
2.	https://www.sas.com/en_us/insights/analytics/big-data-analytics.html

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	3
CO2	3	3	2	3	3	3
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	3
CO5	3	3	2	3	3	2
Weightage of coursecontributed to each PSO	15	14	11	15	15	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Information Security	Elective Core	4	-	-	-	3	4	25	75	100

Learning Objectives	
LO1	To comprehend the basic concepts of cryptography and threats of attacks
LO2	To understand various authentication methods and protocols in relevance to operating system security.
LO3	To decipher various software security threats such as malwares, viruses, worms, etc.
LO4	To demonstrate various network security issues such as IP Spoofing, Firewalls, etc.
LO5	To discuss database security requirements, its integrity and reliability concerns.

UNIT	Contents	No. Of. Hours
I	**Introduction to Computer Security**: Vulnerabilities - Threats and attacks - Public key cryptography and cryptanalysis - knapsack cryptosystem – Control against program threats.	**12**
II	**Operating System Security:** Authentication methods and protocols - Password based authentication - Token base authentication - Biometric authentication - Digital certificates - X-509 directory services – PKI - Needham Schroeder Authentication protocol - Single sign-on Kerberos Authentication Protocol - Federated Identitymanagement. Access control: Policies, DAC, MAC, RBAC - Access control matrix - ACLs and capability lists - multiple level security models. Linux security model: File system security - Linux vulnerabilities - Windows security architecture – windows vulnerabilities.	12
III	**Software security:** Software flaws - Buffer overflow - Incomplete mediation - Race conditions. Malware: Viruses, Worms, Trojans, Logic	**12**

	bomb, Bots and Root kits. Miscellaneous software attacks: Salami attack, Linearization attacks. Trusted computing: Software reverse engineering - Digital rights management	
IV	**Network security:** Basics, TCP/IP vulnerabilities layer wise: Packet sniffing - ARP spoofing - port scanning - IP spoofing - TCP syn flood - DNS spoofing. Internet security protocols: SSL – TLS – IPSEC - secure Email and S/MIME. Denial of service: classic DOS attacks - sourceaddress spoofing - ICMP flood - SYN flood - UDP flood - Distributed denial of service - Defense against denial of service attacks. Firewalls, Intrusion detection systems: Host based and network based IDS - Honey pots.	12
V	**Database Security:** Security requirements – Reliability and Integrity, Sensitive data – Interface – Multilevel Database – Proposals of multilevel security.	12
	TOTAL HOURS	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Ability to comprehend the basic concepts of cryptography and threats of attacks	PO1
CO2	Analyze various authentication methods and protocols in relevance to operating system security.	PO1, PO2
CO3	Decode various software security threats such as malwares, viruses, worms, etc.	PO4, PO5
CO4	Demonstrate various network security issues such as IP Spoofing, Firewalls, etc.	PO3, PO5, PO6
CO5	Discuss database security requirements, its integrity and reliability concerns.	PO3, PO4

Textbooks

1.	Computer security principles and practice, by WilliamStallings, Pearson Education.
2.	Security in Computing by Charles P. Pfleeger andShari Lawrence Pfleeger, Pearson Education.
3.	Cryptography and Network security by Behrouz A.Forouzon, Tata McGraw Hill.

Reference

1.	Information security principles and practice by MarkStamp, Wiley publication.
2.	Network security bible 2nd edition by Eric Cole,Wiley India.

Web Resources

1.	https://www.owasp.org/index.php/Top_10_2013

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcoursecontributedtoeachPSO	**15**	**14**	**11**	**15**	**15**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	NATURAL LANGUAGE PROCESSING	**Elective**	4	-	-	-	3	25	75	100

Learning Objectives	
LO1	To understand approaches to syntax and semantics in NLP.
LO2	To learn natural language processing and to learn how to apply basic algorithms in this field.
LO3	To understand approaches to discourse, generation, dialogue and summarization within NLP.
LO4	Toget acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.
LO5	To understand current methods for statistical approaches to machine translation.

UNIT	**Contents**	**No. of. Hours**
I	**Introduction :** Natural Language Processing tasks in syntax, semantics,and pragmatics – Issue- Applications – The role of machine learning –Probability Basics –Information theory – Collocations -N-gram LanguageModels – Estimating parameters and smoothing – Evaluating languagemodels.	**12**
II	**Word level and Syntactic Analysis:** Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.	**12**
III	**Semantic analysis and Discourse Processing:** Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.	**12**
IV	**Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG. Machine Translation: Problems in Machine Translation. Characteristics of Indian Languages-Machine Translation Approaches-Translation involving Indian Languages.	**12**
V	**Information retrieval and lexical resources:** Information Retrieval:	
	Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame NetStemmers- POS Tagger- Research Corpora SSAS.	**12**
TOTAL		**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Describe the fundamental concepts and techniques of natural language processing. Explain the advantages and disadvantages of different NLP technologies and their applicability in different business situations.	PO1, PO2,PO3, PO4,PO5, PO6
CO2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each Use NLP technologies to explore and gain a broad understanding Of text data.	PO1, PO2,PO3, PO4,PO5, PO6
CO3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions. Use NLP methods to analyse sentiment of a text document.	PO1, PO2,PO3, PO4,PO5, PO6
CO4	Analyze large volume text data generated from a range of real-world applications Use NLP methods to perform topic modelling.	PO1, PO2,PO3, PO4,PO5, PO6
CO5	Develop robotic process automation to manage business processes and to increase and monitor their efficiency and effectiveness. Determine the framework in which artificial intelligence and the Internet of things may function, including interactions with people, enterprise functions, and environments.	PO1, PO2,PO3, PO4,PO5, PO6
Textbooks		
1	Daniel Jurafsky, James H. Martin, “Speech & language processing”, Pearson publications.	
2	Allen, James. Natural language understanding. Pearson, 1995.	
ReferenceBooks		
1.	Pierre M. Nugues, “An Introduction to Language Processing with Perl and Prolog”,Springer	
WebResources		
1.	https://en.wikipedia.org/wiki/Natural_language_processing	
2.	https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	1
CO2	2	3	3	3	2	3
CO3	1	3	3	3	1	3
CO4	3	2	1	3	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	12	14	13	15	11	13

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
	Virtual And Augmented Reality	Core	4	-	-	-	3	4	25	75	100

Learning Objectives		
LO1	To provide knowledge on basic principles of virtual & augmented reality and have the ability to use its technology as a platform for real-world applications.	
UNIT	**Details**	**No.of Hours**
I	**Virtual Reality**: The Three I's of VR – History – Early commercial VR Technology – Components of a VR System –**Input Devices:** Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces	12
II	**Output Devices:** Graphics Displays – Sound Displays – Haptic Feedback - **Computer Architecture for VR:** The Rendering Pipeline- PC Graphics Architecture - **VR Programming:** Toolkits and Scene Graphs – Traditional and Emerging Applications of VR	12
III	**Augmented Reality**: Introduction – **Augmented Reality Concepts:** Working Principle of AR – Concepts related to AR- Ingredients of an Augmented Reality Experience	12
IV	Augmented Reality Hardware– Augmented Reality Software– Software to create content for AR Application – Tools and Technologies	12
V	**Augmented Reality Content:** Introduction- Creating Content for Visual, Audio, and other senses – Interaction in AR - **Mobile Augmented Reality:** Introduction – Augmented Reality Applications Areas- Collaborative Augmented Reality	12
	Total	**60**

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
1	Outline the basic terminologies, techniques and applications of VR and AR	PO1
2	Describe different architectures and principles of VR and AR systems	PO1,PO2
3	Use suitable hardware and software technologies for different varieties of virtual and augmented reality applications	PO4,PO6
4	Analyze and explain the behavior of VR and AR technology relates to human perception and cognition	PO4,PO5,PO6
5	Assess the importance of VR/AR content and interactions to implement for the real- world problem	PO3
Text Book		
1	Grigore C. Burdea and Philippe Coiffet, "Virtual Reality Technology", Wiley Student Edition, Second Edition (Unit I: Chapter 1,2 & Unit II: Chapter 3,4,6,8 & 9)	
2	Alan B. Craig(2013), "Understanding Augmented Reality: Concepts and Applications"(Unit III: Chapter 1, 2, Unit IV : Chapter 3, 4 & Unit V: Chapter 5,6,8)	
3	Jon Peddie (2017), "Augmented Reality: Where We Will All Live", Springer, Ist Edition (Unit IV: Chapter 7 (Tools & Technologies)	
Reference Books		
1	Alan Craig & William R. Sherman & Jeffrey D. Will, Morgan Kaufmann(2009), "Developing Virtual Reality Applications: Foundations of Effective Design", Elsevier(Morgan Kaufmann Publishers)	
2	Paul Mealy (2018), "Virtual and Augmented Reality",Wiley	
3	Bruno Arnaldi & Pascal Guitton & Guillaume Moreau(2018), "Virtual Reality and Augmented Reality: Myths and Realities", Wiley	
Web Resources		
1	Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013	
2	Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqlZ9Q	
3	http://msl.cs.uiuc.edu/vr/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	1
CO2	2	3	3	3	2	3
CO3	1	3	3	3	1	3
CO4	3	2	1	3	2	3
CO5	3	3	3	3	3	3
Weightage of course contributed to each PSO	12	14	13	15	11	13

S-Strong-3 M-Medium-2 L-Low-1

Semester -VI

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Computer Networks	Core	6	-	-	-	4	6	25	75	100

Course Objective	
LO1	To learn the basic concepts of Data communication and Computer network
LO2	To learn about wireless Transmission
LO3	To learn about networking and data link layer.
LO4	To study about Network communication.
LO5	To learn the concept of Transport layer

UNIT	Contents	No. of Hours
I	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	18
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	18
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth.	18
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	18
V	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transporet Protocols (ITP) - Network Security: Cryptography	18
	Total	**90**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models	PO1
CO2	To gain knowledge on Telephone systems using wireless network	PO1, PO2

CO3	To understand the concept of MAC	PO4, PO6
CO4	To analyze the characteristics of Routing and Congestion control algorithms	PO4, PO5, PO6
CO5	To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS	PO3, PO4
Text Book		
1	A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.	
Reference Books		
1.	B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition, 2017	
2.	F. Halsall, "Data Communications, Computer Networks and Open Systems", Pearson Education, 2008	
3.	D. Bertsekas and R. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.	
4.	Lamarca, "Communication Networks", Tata McGraw- Hill, 2002	
Web Resources		
1.	https://en.wikipedia.org/wiki/Computer_network	
2.	https://citationsy.com/styles/computer-networks	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**3**	**2**	**3**	**2**	**3**
CO2	**3**	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**2**	**3**
CO4	**3**	**2**	**2**	**2**	**2**	**2**
CO5	**3**	**2**	**2**	**2**	**2**	**3**
Weightage of course contributed to each PSO	**15**	**11**	**11**	**12**	**10**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	.Net Programming	Core	5	-	-	-	4	5	25	75	100
Course Objective											
C1	To identify and understand the goals and objectives of the .NET framework and ASP.NET with C# language.										
C2	To develop ASP.NET Web application using standardcontrols.										
C3	To implement file handling operations.										
C4	To handles SQL Server Database using ADO.NET.										
C5	Understand the Grid view control and XML classes.										

UNIT	Contents	No. of Hours
I	Overview of .NET framework: Common Language Runtime (CLR), Framework Class Library- C# Fundamentals: Primitive types and Variables – Operators - Conditional statements -Looping statements – Creating and using Objects – Arrays – Stringoperations.	15
II	Introduction to ASP.NET - IDE-Languages supported Components -Working with Web Forms – Web form standard controls: Properties and its events – HTML controls -List Controls: Properties and its events.	15
III	Rich Controls: Properties and its events – validation controls: Properties and its events– File Stream classes - File Modes – File Share – Reading and Writing to files – Creating, Moving, Copying and Deletingfiles – File uploading.	15
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controlsand its Properties – DataBinding	15
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating aWeb application.	15
	Total	**75**

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Develop working knowledge of C# programming constructs and the .NET Framework	PO1, PO2, PO6
2	To develop a software to solve real-world problems using ASP.NET	PO2, PO3, PO5
3	To Work On Various Controls Files	PO1, PO3, PO6
4	To create a web application using MicrosoftADO.NET.	PO2, PO6
5	To develop web applications using XML	PO1, PO3, PO6
Text Book		
1	SvetlinNakov, VeselinKolev& Co, Fundamentals of Computer Programming with C#, Faber publication, 2019.	
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill, 2015.	
Reference Books		
1.	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill, 2017.	
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtechpres, 2013.	
3.	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016.	
4.	DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill,2008.	
5.	Matthew MacDonald, Beginning ASP.NET 4 in C# 2010,APRESS,2010.	
Web Resources		
1.	https://www.geeksforgeeks.org/introduction-to-net-framework/	
2.	https://www.javatpoint.com/net-framework	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**3**	**3**	**3**	**2**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**2**	**3**	**3**
CO4	**2**	**2**	**1**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**14**	**13**	**12**	**14**	**14**	**14**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	.Net Programming LAB	Core	-	-	5	-	4	5	40	60	100

Course Objective	
LO1	To develop ASP.NET Web application using standardcontrols.
LO2	To create rich database applications usingADO.NET.
LO3	To implement file handling operations.
LO4	To implement XML classes.
LO5	To utilize ASP.NET security features for authenticating the website

Sl. No	Programs	No. of Hours
1.	Create an exposure of Web applications and tools	75
2.	Implement the Html Controls	
3.	Implement the Server Controls	
4.	Web application using Web controls.	
5.	Web application using List controls.	
6.	Web Page design using Rich control. Validate user input using Validation controls. Working with Fileconcepts.	
7.	Web application using Data Controls.	
8.	Data binding with Web controls	
9.	Data binding with Data Controls.	
10.	Database application to perform insert, update and delete operations.	
11.	Database application using Data Controls to perform insert, delete, edit, paging and sorting operation.	
12.	Implement the Xml classes.	
13.	Implement Authentication – Authorization.	
14.	Ticket reservation using ASP.NET controls.	

15.	Online examination using ASP.NET controls	
	Total	**75**
Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
CO1	To create web applications and implement various controls	PO1, PO2, PO4
CO2	Create web pages in Rich control.	PO3, PO5
CO3	Develop knowledge about file handling operations	PO1, PO4, PO5
CO4	An ability to design XML classes	PO2, PO4, PO6
CO5	To develop a software to solve real-world problems using ASP.NET	PO1,PO3, PO5, PO6
Text Book		
1	SvetlinNakov, VeselinKolev& Co, Fundamentals of Computer Programming with C#, Faber publication, 2019.	
2	Mathew, Mac Donald, The Complete Reference ASP.NET, Tata McGraw-Hill, 2015.	
Reference Books		
1.	Herbert Schildt, The Complete Reference C#.NET, TataMcGraw-Hill,2017.	
2.	Kogent Learning Solutions, C# 2012 Programming Covers .NET 4.5 Black Book, Dreamtech pres, 2013.	
3.	Anne Boehm, Joel Murach, Murach's C# 2015, Mike Murach& Associates Inc.2016.	
4.	DenielleOtey, Michael Otey, ADO.NET: The Complete reference, McGrawHill, 2008.	
5.	Matthew MacDonald, Beginning ASP.NET 4 in C# 2010, APRESS, 2010.	
Web Resources		
1.	https://www.geeksforgeeks.org/introduction-to-net-framework/	
2.	https://www.javatpoint.com/net-framework	

Mapping with Programme Outcomes:

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage of course contributed	**15**	**12**	**10**	**11**	**12**	**13**

to each PSO						

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
	RDBMS with PL /SQL	Elective	5	-	-	-	3	5	25	75	100

Course Objective	
LO1	Describe basic concepts of database system
LO2	Designa Data model and Schemas in RDBMS
LO3	Competentin use of SQL
LO4	Analyze functional dependencies for designing robust Database
LO5	Describe basic concepts of database system

UNIT	**Details**	**No. ofHours**
I	Introduction to DBMS– Data and Information - Database – Database Management System–Objectives-Advantages–Components-Architecture. ER Model: Building blocks of ER Diagram – Relationship Degree–Classification–ER diagram to Tables–IS A relationship– Constraints–Aggregation and Composition–Advantages	15
II	Relational Model: CODD's Rule –Relational DataModel- Key-Integrity–Relational Algebra Operations–Advantages and limitations–Relational Calculus– Domain Relational Calculus - QBE.	15
III	Structure of Relational Database. Introduction to Relational Database Design-Objectives–Tools–Redundancy and Data Anomaly–Functional Dependency-Normalization–1NF–2NF–3NF–BCNF. Transaction Processing–Database Security.	15
IV	SQL:Commands–Datatypes–DDL-Selection,Projection,Join and Set Operations–Aggregate Functions–DML–Modification-Truncation-Constraints–Subquery.	15
V	PL / SQL:Structure-Elements–Operators Precedence–Control Structure–Iterative Control-Cursors-Procedure-Function-Packages–Exceptional Handling-Triggers.	15
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand basic concepts of database system	PO1
2	Design a Data model and Schemas in RDBMS	PO1,PO2
3	Understand Competentinuse of SQL	PO4,PO6

4	Analyze functional dependencies for designing Robust Database	PO4,PO5,PO6
5	Understand basic concepts of database system	PO3
Text Book		
1	.S.Sumathi,S.Esakkirajan,–Fundamentals of Relational Database Management Systemǁ, Springer International Edition 2007.	
Reference Books		
2.	.Abraham Silberchatz,Henry F.Korth,S.Sudarshan,–Database System Concepts, McGraw Hill 2019,7th Edition.	
3.	Alexis Leon & Mathews Leon,–Fundamentals of DBMS,Vijay Nicole Publications 2014, 2nd Edition.	
Web Resources		
1.	NPTEL & MOOC courses titled Relational Database Management Systems	
2.	https://nptel.ac.in/courses/106106093/	
3.	https://nptel.ac.in/courses/106106095/	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**3**	**2**	**1**	**3**	**-**	**-**
CO2	**-**	**-**	**1**	**-**	**2**	**2**
CO3	**3**	**2**	**1**	**3**	**-**	**-**
CO4	**3**	**-**	**1**	**-**	**2**	**2**
CO5	**3**	**2**	**1**	**3**	**2**	**2**
Weightage of course Contributed to each PSO	12	6	5	9	6	6

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Internet of Things and its applications	Elective	5	-	-	-	3	5	25	75	100
Course Objective											
C1	Use of Devices, Gateways and Data Management in IoT.										
C2	Design IoT applications in different domain and be able to analyze their performance										
C3	Implement basic IoT applications on embedded platform										
C4	To gain knowledge on Industry Internet of Things										
C5	To Learn about the privacy and Security issues in IoT										
UNIT	**Details**										**No. of Hours**
I	IoT& Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.										15
II	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.										15
III	IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views										15

IV	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and GasIndustry, Opinions on IoT Application and Value for Industry, Home Management	15
V	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	15
	Total	**75**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
1	Work with big data tools and its analysis techniques.	PO1
2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
4	Perform analytics on data streams.	PO4, PO5, PO6
5	Learn NoSQL databases and management.	PO3, PO5

Text Book

1	Vijay Madisetti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

Reference Books

1.	Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", kindle version.
2.	Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition,.
3	WaltenegusDargie, ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..CunoPfister, "Getting Started with the Internet of Things", O"Reilly Media 2011

Web Resources

1.	https://www.simplilearn.com
2.	https://www.javatpoint.com
3.	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**

CO3	**3**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**2**
Weightage ofcourse contributed to each PSO	**15**	**12**	**11**	**15**	**15**	**14**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst.Hours**	**Marks**		
									CIA	**External**	**Total**
	Agile Project Management	Elective	5	-	-	-	3	5	25	75	100

Course Objective	
LO1	Learning of software design, software technologies and APIs.
LO2	Detailed demonstration about Agile development and testing techniques.
LO3	Learning about Agile Planning and Execution.
LO4	Understanding of Agile Management Design and Quality Check.
LO5	Detailed examination of Agile development and testing techniques.

UNIT	**Details**	**No.of Hours**
I	**Introduction: Modernizing Project Management:** Project Management Needed a Makeover – Introducing Agile Project Management. **Applying the Agile Manifesto and Principles:** Understanding the Agile manifesto – Outlining the four values of the Agile manifesto – Defining the 15 Agile Principles – Adding the Platinum Principles – Changes as a result of Agile Values – The Agile litmus test. **Why Being Agile Works Better:** Evaluating Agile benefits – How Agile approaches beat historical approaches – Why people like being Agile.	15

II	**Agile Approaches:** Diving under the umbrella of Agile approaches – Reviewing the Big Three: Lean, Scrum, Extreme Programming - Summary **Agile Environments in Action:** Creating the physical environment – Low-tech communicating – High-tech communicating – Choosing tools. **Agile Behaviours in Action:** Establishing Agile roles – Establishing new values – Changing team philosophy.	15
III	**Agile Planning and Execution** **Defining the Product Vision and Road map:**Agile planning–Defining the product vision – Creating a product roadmap – Completing the product backlog. **Planning Releases and Sprints:** Refining requirements and estimates – Release planning–Sprint planning. **Working Through out the Day:**Planning yourday–Tracking progress – Agile roles in the sprint – Creating shippable functionality – The end of the day. **Show casing Work, Inspecting and Adapting:** The sprint review – The sprint retrospective. **Preparing for Release:** Preparing the product for deployment (thereleasesprint)– Preparing the operational support–Preparing the organization for product deployment - Preparing the market place for product deployment	12
IV	**Agile Management** **Managing Scope and Procurement:** What‘s different about Agile scope management–Managing Agile scope–What‘s different about Agile procurement–ManagingAgile procurement. **Managing Time and Cost:** What‘s different about Agile time management–Managing Agile schedules–What‘s different about Agile cost management–Managing Agile budgets. **Managing Team Dynamics and Communication:** What‘s different about Agile team dynamics– Managing Agile teamd ynamics–What‘s Different about Agile communication–Managing Agile communication. **Managing Quality and Risk:**What‘s different about Agile quality–Managing Agile quality–What‘s different about Agile risk management –Managing Agile risk.	12

V	**Implementing Agile** **Building a Foundation:** Organizational and individual commitment – Choosing the right pilot team members – Creating and environment that enables Agility – Support Agility initially and over time. **Being a Change Agent:** Becoming Agile requires change – why change doesn't happen on its own – Platinum Edge's Change Roadmap – Avoiding pitfalls – Signs your changes are slipping. **Benefits, Factors for Success and Metrics:** Ten key benefits of Agile project management – Ten key factors for project success – Ten metrics for Agile Organizations.	12
	Total	**75**

CourseOutcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understanding of software design, software technologies and APIs using Agile Management.	PO1
2	Understanding of Agile development and testing techniques.	PO1,PO2
3	Understanding about Agile Planning and Execution using Sprint.	PO4,PO6
4	Understanding of Agile Management Design, scope, Procurement, managing Time and Cost and Quality Check.	PO4,PO5,PO6

5	Analysing of Agile development and testing techniques.	PO3
Text Book		
1	Mark C. Layton, Steven J. Ostermiller, Agile Project Management for Dummies, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
	Jeff Sutherland, Scrum – The Art of Doing Twice the Work in Half the Time, Penguin, 2014.	
ReferenceBooks		
1.	Mark C. Layton, David Morrow, *Scrum for Dummies*, 2nd Edition, Wiley India Pvt. Ltd., 2018.	
2.	Mike Cohn, Succeeding with Agile – Software Development using Scrum, Addison-Wesley Signature Series, 2010.	
3.	Alex Moore, Agile Project Management, 2020.	
4.	Alex Moore, *Scrum*, 2020.	
5.	Andrew Stellman and Jennifer Greene, *Learning Agile: Understanding Scrum, XP, Lean, and Kanban*, Shroff/O'Reilly, First Edition, 2014.	
WebResources		
1.	www.agilealliance.org/resources	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**3**	**1**	**2**	**1**	**2**
CO2	**3**	**1**	**2**	**1**	**3**	**1**
CO3	**3**	**2**	**1**	**1**	**3**	**1**
CO4	**3**	**2**	**3**	**2**	**1**	**3**
CO5	**2**	**3**	**1**	**2**	**3**	2
Weightageofcourse contributedtoeach PSO	13	11	8	8	11	9

S-Strong-3 M-Medium-2L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	SOFTWARE PROJECT MANAGEMENT	**Elective**	**5**	**-**	**-**	**-**	**3**	**5**	**25**	**75**	**100**

Learning Objectives

LO1	To define and highlight importance of software project management.
LO2	To formulate and define the software management metrics & strategy in managing projects
LO3	To famialarize in Software Project planning
LO4	Understand to apply software testing techniques in commercial environment

Unit	Contents	No. of Hours
I	Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models - The SEI CMM - International Organization for Standardization.	**15**
II	Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project -Project Planning - Creating the Work Breakdown Structure - Approaches to Building a WBS - Project Milestones - Work Packages - Building a WBS for Software.	**15**
III	Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.	**15**
IV	Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.	**15**
V	Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study	**15**
TOTAL		**75**

CO	**Course Outcomes**
CO1	Understand the principles and concepts of project management
CO2	Knowledge gained to train software project managers
CO3	Apply software project management methodologies.
CO4	Able to create comprehensive project plans
CO5	Evaluate and mitigate risks associated with software development process
Textbooks	
1	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, "Quality Software Project Management", Pearson Education Asia 2002.
Reference Books	
1.	PankajJalote, "Software Project Management in Practice", Addison Wesley 2002.
2.	Hughes, "Software Project Management", Tata McGraw Hill 2004, 3rd Edition.
NOTE: Latest Edition of Textbooks May be Used	
Web Resources	
1.	Software Project Management e-resources from Digital libraries
2.	www.smartworld.com/notes/software-project-management

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightageofcoursecontributed toeachPSO	**13**	**11**	**10**	**13**	**13**	**12**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks		
									CIA	External	Total
	Biometric Techniques	Core	5	-	-	-	3	5	25	75	100

Course Objective		
LO1	To understand various physiological and behavioural biometrics and its applications	
UNIT	**Details**	**No.of Hours**
I	Introduction: Biometric Fundamentals - Biometrics Vs Traditional Techniques - Benefits of Biometrics in Identification Systems - Key Biometric Terms and Processes: Verification, Identification and Biometric Matching - Accuracy in Biometric Systems: False Match Rate, False Non-Match Rate, Failure to Enroll Rate, DerivedMetrics	15
II	Physiological Biometrics: Finger Scan: Components-How it works-Competing Technologies- Deployments-Strengths and Weaknesses. Facial Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses	15
III	Other Physiological Biometrics: Iris Scan: Components- How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Voice Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Other Physiological Biometrics: Hand Scan and Retina Scan	15
IV	Behavioural Biometrics: Signature Scan and Keystroke Scan: How it Works-Competing Technologies-Deployments-Strengths and Weaknesses. Esoteric Biometrics: Vein Pattern- Facial Thermography-DNA- Sweat Pores- Hand Grip- Finger Nail Bed- Body Odor- Ear-Gait- Skin Luminescence- Brain Wave Pattern- Foot Print and Foot Dynamics	15
V	Biometric Applications: Categorizing Biometric Applications - Application Areas: Criminal and Citizen Identification, Surveillance, PC/Network Access, E-Commerce/Telephony and Retail/ATM - Costs to Deploy -Issues in Deployment- Biometric Standards	15
	Total	**75**
Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	

1	Outline the existing theories, methods and interpretations in thefield of biometrics	PO1
2	Identify the deployment areas, competing technologies, strength and weakness of various Physiological and Behavioral Biometrics	PO1,PO2
3	Analyze various Applicationareas, Biometric security issues andBiometric standards	PO4,PO6
4	Assess the methods relevant for design, development and operation of biometric access control systems	PO4,PO5, PO6
5	Determine identification /verification systems to validate the user identityand technological uplifts in biometrics comparedto traditional securing mechanisms	PO3
Text Book		
1	Samir Nanavati, Michael Thieme, Raj Nanavati,(2003),Biometrics	
2	John D. Woodward, Nicholas M. Orlans, Peter T. Higgins, Biometrics: the ultimate reference, DreamtechPress	
Reference Books		
1	Anil K Jain, Patrick Flynn, Arun A Ross, (2008), Handbook of Biometrics, Springer	
Web Resources		
1	http://www.sans.org/reading-room/whitepapers/authentication/biometric-scanning/	
2	http://www.biometrics.gov/documents/biointro.pdf	
3	http://www.cse.unr.edu/~bebis/CS790Q/Lect/IntroBiometrics.pdf	

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/PSO	**PSO1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**3**	**1**	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**2**
CO5	**2**	**2**	**2**	**3**	**3**	**3**
Weightageofcoursecontributed toeachPSO	**13**	**11**	**10**	**13**	**13**	**12**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Artificial Intelligence	Elective	5	-	-	-	3	5	25	75	100
Course Objective											
C1	To learn various concepts of AI Techniques.										
C2	To learn various Search Algorithm in AI.										
C3	To learn probabilistic reasoning and models in AI.										
C4	To learn about Markov Decision Process.										
C5	To learn various type of Reinforcement learning.										

UNIT	Contents	No. of Hours
I	Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree	15
II	Search Algorithms : Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search	15
III	Probabilistic Reasoning : Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.	15
IV	Markov Decision process : MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.	15
V	Reinforcement Learning : Passive reinforcement learning, direct utility	15

	estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning	
	Total	**75**

Course Outcomes		**Programme Outcome**
CO	On completion of this course, students will	
1	Understand the various concepts of AI Techniques.	PO1
2	Understand various Search Algorithm in AI.	PO1, PO2
3	Understand probabilistic reasoning and models in AI.	PO4, PO6
4	Understand Markov Decision Process.	PO4, PO5, PO6
5	Understand various type of Reinforcement learning Techniques.	PO3, PO4

Text Book	
1	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall.
	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill

Reference Books	
1.	Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
2.	SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2011
3.	David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010

Web Resources	
1.	https://github.com/dair-ai/ML-Course-Notes
2.	https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html
3.	https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXlRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE

Mapping with Programme Outcomes:

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
CO1	**3**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**2**	**2**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**2**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**3**
Weightage ofcoursecontributedto eachPSO	**15**	**12**	**10**	**11**	**12**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	Advanced Excel	Skill Enha. Course (SEC)	4	-	-	-	2	4	25	75	100

Learning Objectives	
LO1	Handle large amounts of data
LO2	Aggregate numeric data and summarize into categories and subcategories
LO3	Filtering, sorting, and grouping data or subsets of data
LO4	Create pivot tables to consolidate data from multiple files
LO5	Presenting data in the form of charts and graphs

UNIT	Contents	No. of Hours
I	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	12
II	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data -Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	12
III	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	12

IV	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- What If Analysis - Goal Seek- Data Tables- Scenario Manager.	12
V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	12
	Total	**60**

Course Outcomes		**Programme Outcomes**
CO	On completion of this course, students will	
CO1	Work with big data tools and its analysis techniques.	PO1
CO2	Analyze data by utilizing clustering and classification algorithms.	PO1, PO2
CO3	Learn and apply different mining algorithms and recommendation systems for large volumes of data.	PO4, PO6
CO4	Perform analytics on data streams.	PO4, PO5, PO6
CO5	Learn No-SQL databases and management.	PO3

Text Book	
1	**Excel 2019 All**
2	**Microsoft Excel 2019 Pivot Table Data Crunching**
Reference Books	
1	Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition
Web Resources	
1.	https://www.simplilearn.com
2	https://www.javatpoint.com
3	https://www.w3schools.com

Mapping with Programme Outcomes:

CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**3**

CO4	**3**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**2**	**2**	**3**	**3**	**3**
Weightage of course contributed to each PSO	**15**	**12**	**10**	**15**	**15**	**15**

Strong-3 M-Medium-2 L-Low-1

Fourth Year
Semester –VII

Course code		ADVANCED SOFTWARE ENGINEERING	L	T	P	C
Core/Elective/Supportive		Elective	5			4
Pre-requisite		Basics of Software Engineering &SPM				

Course Objectives:

The main objectives of this course are to:

1. Introduce to Software Engineering, Design, Testing and Maintenance.
2. Enable the students to learn the concepts of Software Engineering.
3. Learn about Software Project Management, Software Design &Testing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand about Software Engineering process	K1,K2
2	Understand about Software project management skills, design and quality management	K2,K3
3	Analyze on Software Requirements and Specification	K3,K4
4	Analyze on Software Testing, Maintenance and Software Re-Engineering	K4,K5
5	Design and conduct various types and levels of software quality for a software project	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15 hours

Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.

Unit:2	SOFTWAREREQUIREMENTS	15 hours

Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management –Software Quality, Software Quality Management System, ISO 9000, SEI CMM.

Unit:3	PROJECT MANAGEMENT	15 hours
Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead‟s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.		
Unit:4	**SOFTWAREDESIGN**	**15 hours**
Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.		
Unit:5	**SOFTWARETESTING**	**13 hours**
Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testing tools-Metrics-Reliability Estimation. Software Maintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**75 hours**

Text Books	
1	An Integrated Approach to Software Engineering–PankajJalote, Narosa Publishing House, Delhi, 3rd Edition.
2	Fundamentals of Software Engineering –Rajib Mall, PHI Publication, 3rd Edition.
Reference Books	
1	Software Engineering–K.K.Aggarwal and Yogesh Singh, New Age International Publishers, 3rd edition.
2	A Practitioners Approach- Software Engineering,-R.S.Pressman, McGraw Hill.
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Mano drioli, PHI Publication.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.javatpoint.com/software-engineering-tutorial
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite		Basics of any OO Programming Language				

Course Objectives:

The main objectives of this course are to:

1. Presents an introduction to Python, creation of web applications, network applications and working in the clouds
2. Use functions for structuring Python programs
3. Understand different Data Structures of Python
4. Represent compound data using Python lists, tuples and dictionaries

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic concepts of Python Programming	K1,K2
2	Understand File operations, Classes and Objects	K2,K3
3	Acquire Object Oriented Skills in Python	K3,K4
4	Develop web applications using Python	K5
5	Develop Client Server Networking applications	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	18 hours

Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.

Unit:2	CODESTRUCTURES	18 hours

Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.

Unit:3	MODULES,PACKAGESANDCLASSES	18 hours

Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. **Objects and Classes:** Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent with super–Inself Defense –Get and Set Attribute Values with Properties –Name Mangling for Privacy – Method Types – Duck Typing – Special Methods –Composition.

Unit:4	DATATYPESANDWEB	18 hours

Data Types: Text Strings–Binary Data. **Storing and Retrieving Data:** File Input / Output– Structured Text Files – Structured Binary Files - Relational Databases – No SQL Data Stores.

Web : Web Clients –Web Servers–Web Services and Automation

Unit:5	SYSTEMS AND NETWORKS	16 hours
Systems: Files–Directories–Programs and Processes–Calendars and Clocks. **Concurrency:** Queues– Processes–Threads–Green Threads and event–twisted–Radis. **Networks:** Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – Zero MQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and Map Reduce – Working in the Clouds.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**90 hours**

Text Books

1	BillLu banovic, "Introducing Python", O'Reilly, First Edition-Second Release, 2014.
2	MarkLutz, "Learning Python", O'Reilly, Fifth Edition, 2013.

ReferenceBooks

1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition,2009.
2	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach", Pearson Publications.

Related Online Contents[MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	S	M
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	S	M
CO5	S	S	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code		PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Core			5	4
Pre-requisite		Basics of any OO Programming Language				

Course Objectives:

The main objectives of this course are to:

1. This course presents an overview of elementary data items, lists, dictionaries, sets and tuples
2. To understand and write simple Python programs
3. To Understand the OOPS concepts of Python
4. To develop web applications using Python

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to write programs in Python using OOPS concepts	K1,K2
2	To understand the concepts of File operations and Modules in Python	K2,K3
3	Implementation of lists, dictionaries, sets and tuples as programs	K3,K4
4	To develop web applications using Python	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	75hours

Implement the following in Python:

1. Programs using elementary data items, lists, dictionaries and tuples
2. Programs using conditional branches,
3. Programs using loops.
4. Programs using functions
5. Programs using exception handling
6. Programs using inheritance
7. Programs using polymorphism
8. Programs to implement file operations.
9. Programs using modules.
10. Programs for creating dynamic and interactive web pages using forms.

Total Lecture hours	75 hours

Text Books

1	BillLubanovic, “Introducing Python”, O’Reilly, First Edition-Second Release, 2014.
2	MarkLutz, “Learning Python”, O’Reilly, Fifth Edition, 2013.

Reference Books	
1	David M. Beazley, "Python Essential Reference", Developer's Library, Fourth Edition, 2009.
2	Sheetal Taneja, Naveen Kumar, "Python Programming-A Modular Approach",Pearson Publications.
Related Online Contents[MOOC, SWAYAM, NPTEL,Websitesetc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	M
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		**DESIGN AND ANALYSIS OF ALGORITHMS**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core**	5			3
Pre-requisite		Basic Data Structures& Algorithms				

Course Objectives:

The main objectives of this course are to :

1. Enable the students to learn the Elementary Data Structures and algorithms.
2. Presents an introduction to the algorithms, their analysis and design
3. Discuss various methods like Basic Traversal And Search Techniques, divide and conquer method, Dynamic programming, backtracking
4. Understood the various design and analysis of the algorithms.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.	K1,K2
2	Gain good understanding of Greedy method and its algorithm.	K2,K3
3	Able to describe about graphs using dynamic programming technique.	K3,K4
4	Demonstrate the concept of backtracking & branch and bound technique.	K5,K6
5	Explore the traversal and searching technique and apply it for trees and graphs.	K6

K1-Remember; **K2**-Understand; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	15hours
Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heap sort- Graph.		
Unit:2	**TRAVERSAL AND SEARCH TECHNIQUES**	**15hours**
Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.		
Unit:3	**GREEDY METHOD**	**15hours**
The Greedy Method:-General Method–Knapsack Problem–Minimum Cost Spanning Tree– Single Source Shortest Path.		
Unit:4	**DYNAMIC PROGRAMMING**	**15hours**
Dynamic Programming-General Method–Multistage Graphs–All Pair Shortest Path–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.		
Unit:5	**BACKTRACKING**	**13hours**
Backtracking:-General Method–8-QueensProblem–Sum Of Subsets–Graph Coloring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars– webinars		
	Total Lecture hours	**75hours**

	Text Books
1	Ellis Horowitz,“ComputerAlgorithms”,Galgotia Publications.
2	AlfredV.Aho, JohnE. Hopcroft, Jeffrey D.Ullman,"DataS tructures and Algorithms".
	ReferenceBooks
1	Goodrich,“ Data Structures & Algorithms in Java”,Wiley3rd edition.
2	Skiena,”The Algorithm Design Manual”,Second Edition,Springer,2008
3	Anany Levith,” Introduction to the Design and Analysis of algorithm”,Pearson Education Asia, 2003.
4	Robert Sedge wick, Phillipe Flajolet,”An Introduction to the Analysis of Algorithms”, Addison-Wesley Publishing Company,1996.
	Related Online Contents [MOOC, SWAYAM, NPTEL,Websitesetc.]
1	https://nptel.ac.in/courses/106/106/106106131/
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3	https://www.javatpoint.com/daa-tutorial

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	M	S	L	M	L	S	M
CO2	S	S	S	S	S	M	S	M	S	M
CO3	S	S	S	S	S	M	S	M	S	M
CO4	S	S	S	S	S	M	S	M	S	M
CO5	S	S	S	S	S	M	S	M	S	M

Course code		**Human Computer Interaction**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Elective**	5			3
Pre-requisite						

Course Objectives:

To learn the foundations of Human Computer Interaction.

To become familiar with the design technologies for individuals and persons with disabilities.

To be aware of mobile HCI.

To learn the guidelines for user interface.

To encourage to design certain tools for blind or differently abled people

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Design effective dialog for HCI	K1, K2
2.	Design effective HCI for individuals and persons with disabilities.	K2, K3
3.	Assess the importance of user feedback.	K4, K5
4.	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.	K5, K6
5.	Develop a meaningful user interface.	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	**15hours**

FOUNDATIONS OF HCI The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity Paradigms. - Case Studies

Unit:2	**15hours**

DESIGN & SOFTWARE PROCESS Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

Unit:3	**15hours**

MODELS AND THEORIES HCI Models: Cognitive models: Socio Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit:4		**15hours**
MOBILE HCI Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies		
Unit:5		**15hours**
WEB INTERFACE DESIGN Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies		
	Total Lecture hours	**75hours**

Text Books	
1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale;Human Computer Interaction; Pearson Education; 3rd Edition; 200
2	Brian Fling;Mobile Design and Development;First Edition; O'Reilly Media Inc.;2009
3	Bill Scott and Theresa Neil;Designing Web Interfaces; First Edition; O'Reilly, 2009.
Reference Books	
1	Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2	Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3	User Interface Design, Soren Lauesen , Pearson Education.
4	Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5	Human –Computer Interaction, Smith - Atakan, Cengage Learning.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.youtube.com/watch?v=q81KXc54Ozs&list=PLxtKZf9nLWO3d2a6M8l2BU8WTJKzHC4HJ

Mapping with Programme Outcomes:

CO1	M	S	M	S	M	S	L	M	L	L
CO2	S	M	M	S	M	M	S	L	M	L
CO3	L	M	S	L	M	S	M	L	S	M
CO4	S	L	L	M	M	L	L	S	M	S
CO5	M	S	M	L	S	M	M	L	M	L

S-Strong M-Medium L-Low

Core Course	High Performance Computing	L	T	P	C
Core/Elective/Supportive	Elective	5			3
Pre-requisite					

Course Objectives:

To get a clear idea of High Performance Computing concept.
To get brief knowledge about how to function the HPC systems
To get idea of what techniques used in HPC models.
To understand a Parallel computing concepts.
To get familiar with OpenMP technology that is widely used in HPC technology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand of the HPC and ccNUMA concepts	K1
2	Design and develop a parallel programming with modern C, C++ and newversion of FORTRAN	K2
3	Apply with parallel computing	K3
4	Develop an efficient OpenMP programming	K4, K5
5	Evaluate an efficient MPI programming	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		**15 hours**

Modern processors: Stored-program computer architecture-General purpose cache based microprocessor architecture-Memory hierarchies-Multicore processors-Multithreaded processors-Vector processors. Basic optimization techniques for serial code: Scalar profiling- Common sense optimizations-Simple measures, large impact-The role of compilers-C++ optimizations.

Unit:2		**15 hours**

Data access optimization: Balance analysis and light speed estimates-Storage order- Algorithm classification and access optimizations-The Jacobi algorithm-Algorithm classification and access optimizations-Sparse matrix-vector multiply. Parallel computers: Taxonomy of parallel computing paradigms-Shared-memory computers-Distributed memory computers- Hierarchical systems-Networks.

Unit:3		**15 hours**

Basics of parallelization: Introduction to Parallelism -Parallel scalability. Shared memory parallel programming with OpenMP: Short introduction to OpenMP-OpenMP-parallel Jacobi algorithm.

Unit:4		15 hours
Efficient OpenMP programming: Profiling OpenMP programs-Performance pitfalls- Parallel sparse matrix-vector multiply. Locality optimizations on ccNUMA architectures: Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls- ccNUMA issues with C++.		
Unit:5		**15 hours**
Distributed-memory parallel programming with MPI: Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. Efficient MPI programming: MPI performance tools-Communication parameters-Synchronization, serialization, contention- Reducing communication overhead-Understanding intranode point-to-point communication.		
	Total Lecture hours	**75 hours**

Text Books	
1	Georg Hager, Gerhard Wellein "Introduction to High Performance Computing for Scientists and Engineers", CRC Press, 2011.Chapters: 1 to 10.

Reference Books	
1.	Michael W. Berry, Kyle A. Gallivan, EfstratiosGallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
2.	Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	L	M	L	L	L
CO2	S	M	L	M	M	L
CO3	S	S	S	M	M	L
CO4	S	S	S	M	S	L
CO5	S	S	S	M	M	L

S-Strong M-Medium L-Low

Course code		Object Oriented Analysis and Design	L	T	P	C
Core/Elective/Supportive		Elective	5			3
Pre-requisite						

Course Objectives:

- To understand Development life cycle model and UML approaches
- To comprehend class object attributes and methods and its use case models
- To analyse design axioms and object interoperability
- To decode quality assurance testing strategies and debugging principles.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

CO1	Understand Development life cycle model and UML approaches	K1
CO2	Comprehend class object attributes and methods and its use case models	K1, K2
CO3	Analyse design axioms and object interoperability	K3
CO4	Design micro level processes	K4, K5
CO5	Decode quality assurance testing strategies and debugging principles.	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		15 hours

System Development - Object Basics - Development Life Cycle - Methodologies - Patterns - Frameworks - Unified Approach - UML.

Unit:2		15 hours

Use-Case Models - Object Analysis - Object relations - Attributes - Methods - Class and Object responsibilities - Case Studies.

Unit:3		15 hours

Design Processes - Design Axioms - Class Design - Object Storage - Object Interoperability - Case S tudies.

Unit:4		15 hours

User Interface Design - View layer Classes - Micro- Level Processes - View Layer Interface - Case Studies.

Unit:5		15 hours

Quality Assurance Tests - Testing Strategies - Object orientation on testing - Test Cases - test Plans - Continuous testing - Debugging Principles - System Usability

	Total Lecture hours	**75hours**
Text Books		
1	Ali Bahrami - Object Oriented Systems Development -McGraw Hill International Edition – 1999	
2	Grady Booch- Object Oriented Analysis and design –Addison Wesley.	
Reference Books		
1.	Ramnath, Sarnath, and Brahma Dathan. *Object- oriented analysis and design*. Springer Science &Business Media, 2010.	
2.	Kahate, Atul. *Object Oriented Analysis & Design*.Tata McGraw-Hill Education, 2004	

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	S	S	M	S	M	L
CO 2	S	M	S	L	S	L
CO 3	M	S	L	M	M	S
CO 4	L	S	S	L	S	M
CO 5	S	L	M	S	L	L

S–Strong M–Medium L–Low

Course code		PARALLEL COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	5			3
Pre-requisite						

Course Objectives:

To understand the need and fundamentals of parallel computing paradigms
To learn the nuances of parallel algorithm design
To understand the programming principles in parallel and distributed computingarchitectures
To learn few problems that are solved using parallel algorithms

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Define the scope of parallel computing, design paradigms and model of parallel computing.	K1, K2
2	Perform classification of parallel computing based on Divide and Conquer strategies.	K2, K3
3	Apply the parallel programming design paradigms and programming models and standards.	K4
4	Deduce shared memory concepts used in parallel computing models such as openMP.	K5
5	Design a Multi-core programming Tread building blocks and cilk++ programming.	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1 **15 hours**

Introduction to Parallel Computing: Why Parallel Computing & Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing,examples, Bulk Synchronous Parallel (BSP)

model.

Unit:2 **15 hours**

Classification: Flynn's Taxonomy, MPP, SMP, CC-NUMA, Clustering of Computers, Beowulf Cluster, Use of MPI in Cluster Computing. Debugging, Evaluating and tuning of Cluster Programs, Partitioning and Divide and Conquer Strategies. Cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing, Interconnection networks.

Unit:3 **15 hours**

An overview of Parallel Programming Paradigms: Foster's design paradigm for Multi computing programming, Programmability Issues, Programming Models: Message passing, Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface) and its routines,Advanced Features of MPI.

Unit:4		15 hours
Overview of Programming with Shared Memory: Overview of Programming with Shared Memory: OpenMP (History, Overview, Programming Model, OpenMP Constructs, Performance Issues and examples, Explicit Parallelism: Advanced Features of Open MP)		
Unit:5		**15 hours**
Multi-Core programming: Multi-Core programming: Introduction to Multi cores Programming Software Multi- threading using Tread Building Blocks (TBB) and Cilk++ programming, GPGPU programming with CUDA.		
	Total Lecture hours	**75hours**

Text Books	
1	Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).
2	Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.
Reference Books	
1.	William Gropp, Rusty Lusk, Tuning MPI Applications for Peak Performance, Pittsburgh (1996).
2.	W. Gropp, E. Lusk, N. Doss, A. Skjellum, A high performance portable implementation of the message passing Interface (MPI) standard, Parallel Computing.

Course code		Text Mining	L	T	P	C
Core/Elective/Supportive		Elective	5			3
Pre-requisite		-				

Course Objectives:

To understand the knowledge of text mining and pre-processing techniques
To understand and apply the data mining classification techniques
To understand and apply Probabilistic Model for text mining.
To apply the text mining approaches with case studies.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic issues and types of text mining	
2	Appreciate the different aspects of text categorization and clustering.	
3	Understand the role played by text mining in information retrieval extraction.	
4	Analyze the currents trends in text mining.	
5	Design a text analytic framework to analyze text data for specific domain	

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		15 hours

Text Mining - Definition - General Architecture - Core Text mining Operations. Pre-processing- Textual information to numerical vectors - Collecting documents - document standardization and Representation - tokenization - lemmatization - stemming - Parsing text - keywords, n-grams - POS, Corpus - sentence boundary determination - vector generation for prediction.

Unit:2		15 hours

Text Categorization - Definition - knowledge engineering, Machine Learning – Classification - Decision Tree Classifiers -Rule - based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers - Classification of Linked and Web Data - Meta-Algorithms - Clustering – Definition - Distance - based Algorithms -Word and Phrase - based Clustering.

Unit:3		15 hours

Information Retrieval and Text Mining - Key Word Search -Measuring Similarity - Web - based document search -DocumentMatching - Inverted Lists - Evaluation of Performance. Information extraction - Architecture - Co- reference - Named Entity and Relation Extraction - Template filling and database construction - Applications.

Unit:4		15 hours
Text Summarization Techniques - Topic Representation - Influence of Context - Indicator representations and Machine Learning for Summarization - Selecting summary sentences - Visualization Approaches - Architectural Considerations - Common Visualization. Approaches for text mining - Applications.		
Unit:5		**15 hours**
Probabilistic Models for Text Mining - Mixture Models -Stochastic Processes in Bayesian Nonparametric Models - Graphical Model - Hidden Markov Models - StochasticContext-Free Grammars - Maximal Entropy Modeling - Maximal Entropy Markov Models - Conditional Random Fields.		
	Total Lecture hours	**75hours**

Text Books	
1	Ronen Feldman, James Sanger, "The Text Mining Handbook: Advanced Approachesin Analyzing Unstructured Data", Cambridge University press, 2006.
2	Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau, "The Text MiningHandbook: Advanced Approaches in Analyzing Unstructured Data", Springer, 2010.
Reference Books	
1	Charu C. Aggarwal ,ChengXiangZhai,Mining Text Data, Springer; 2012.
2	Markus Hofmann, Andrew Chisholm, "Text Mining and Visualization: Case StudiesUsing Open-Source Tools", CRC press, Taylor & Francis, 2016.

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	2	1	2
CO2	2	3	2	2	2	1
CO3	3	3	2	2	1	2
CO4	2	3	3	2	2	1
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	13	15	12	10	8	9

S-Strong-3 M-Medium-2 L-Low-1

Course code		UML Practical	L	T	P	C
Core/Elective/Supportive		Skill Enhancement			2	2
Pre-requisite						

Course Objectives:

To capture the requirements specification for an intended software system
To draw the UML diagrams for the given specification
To map the design properly to code
To test the software system thoroughly for all scenarios
To improve the design by applying appropriate design patterns.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify use cases and develop the Use Case model.	K1
2	Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.	K2
3	Using the identified scenarios, find the interaction between objects andrepresent them	K2, K3
4	Using UML Sequence and Collaboration Diagrams and Draw relevant State Chart and Activity Diagrams for the same system.	K4
5	Implement the modified system and test it for various scenarios	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:		30 hours

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

	Total Lecture hours	30 hours

Text Books	
1	Designing Flexible Object Oriented systems with UML - Charles Ritcher
2	Object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
Reference Books	
1.	The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, Ivar Jacobson.
2.	Object Oriented Modeling and Design - James Rumbaugh
3.	Teach Yourself UML in 24 Hours - Joseph Schmuilers

Semester – VIII

Course code		DATA MINING AND WAREHOUSING	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite		Basics of RDBMS &Algorithms				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing.
2. Develop skills of using recent data mining software for solving practical problems.
3. Develop and apply critical thinking, problem-solving, and decision-making skills.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic data mining techniques and algorithms	K1,K2
2	Understand the Association rules, Clustering techniques and Data warehousing contents	K2,K3
3	Compare and evaluate different data mining techniques like classification, prediction, Clustering and association rule mining	K4,K5
4	Design data warehouse with dimensional modeling and apply OLAP operations	K5,K6
5	Identify appropriate data mining algorithms to solve real world problems	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	BASICS AND TECHNIQUES	18 hours

Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.

Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.

Unit:2	ALGORITHMS	18 hours

Classification: Introduction –Statistical –based algorithms -distance–based algorithms-decision tree-based algorithms-neural network–based algorithms–rule-based algorithms–combining Techniques.

Unit:3	CLUSTERING AND ASSOCIATION	18 hours

Clustering: Introduction–Similarity and Distance Measures–Outliers–Hierarchical Algorithms -Partitioned Algorithms.

Association rules: Introduction - large item sets - basic algorithms – parallel & distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.

Unit:4	DATA WAREHOUSING AND MODELING	18 hours
Data warehousing: introduction- characteristics of a data warehouse–data marts–other aspects		
Of data mart. Online analytical processing: introduction –OLTP & OLAP systems Data modeling –star schema for multidimensional view –data modeling – multi factstar schema or snow flake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.		
Unit:5	**APPLICATIONS OF DATA WAREHOUSE**	**16 hours**
Developing a data WAREHOUSE: why and how to build a data warehouse –data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse. Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars –webinars		
	Total Lecture hours	**90 hours**

Text Books	
1	Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics",Pearsoneducation,2003.
2	C.S.R. Prabhu, "Data Warehousing Concepts,Techniques, Productsand Applications", PHI, Second Edition.
Reference Books	
1	ArunK.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd., 2003.
2	Alex Berson, Stephen J.Smith, "Data Warehousing, Data Mining and OLAP ", TMCH, 2001.
3	Jiawei Han &MichelineKamber, "Data Mining Concepts &Techniques", 2001, Academic press.
Related Online Contents [MOOC , SWAYAM, NPTEL, Websitesetc.]	
1	https://www.javatpoint.com/data-warehouse
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite		Basics of OS & its functioning				

Course Objectives:

The main objectives of this course are to:

1. Enable the students to learn the different types of operating systems and their functioning.
2. Gain knowledge on Distributed Operating Systems
3. Gain insight into the components and management aspects of real time and mobile operating systems.
4. Learn case studies in Linux Operating Systems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the design issues associated with operating systems	K1,K2
2	Master various process management concepts including scheduling, deadlocks and distributed file systems	K3,K4
3	Prepare Real Time Task Scheduling	K4,K5
4	Analyze Operating Systems for Hand held Systems	K5
5	Analyze Operating Systems like LINUX and Ios	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	BASICS OF OPERATING SYSTEMS	18 hours

Basics of Operating Systems: What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention – Avoidance – Detection – Recovery.

Unit:2	DISTRIBUTED OPERATING SYSTEMS	18 hours

Distributed Operating Systems: Issues – Communication Primitives – Lamport‟s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

Unit:3	REAL TIME OPERATING SYSTEM	18 hours

Real-time Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

Unit:4	HANDHELD SYSTEM	18 hours

Operating Systems for Hand held Systems: Requirements–Technology Overview–Handheld Operating Systems–Palm OS-Symbian Operating System-Android–Architecture of android–Securing handheld systems

Unit:5	CASE STUDIES	16 hours
Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars–webinars		
	Total Lecture hours	**90 hours**

Text Books

1	Abraham Silberschatz; Peter Baer Galvin;Greg Gagne,“ Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.

Reference Books

1	RajibMall,“Real-Time Systems: Theory and Practice”, Pearson Education India,2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet& Marco Cesati, “Under standing the Linux kernel”,3rd edition,O‘Reilly,2005
4	Neil Smyth,“iPhonei OS4 Development Essentials–Xcode”,Fourth Edition, Payload media, 2011.

Related Online Contents[MOOC, SWAYAM, NPTEL,Websitesetc.]

1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2	https://www.udacity.com/course/advanced-operating-systems--ud189
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	M	S	S	S	S	S	M	S	M
CO3	S	M	S	S	S	S	S	M	S	M
CO4	S	M	S	S	S	S	S	M	S	M
CO5	S	M	S	S	S	S	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code		Web Technology and Advanced Java	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite		Basic Data Structures& Algorithms				

Course Objectives:

Course Objectives

- To provide knowledge and abilities to develop web sites for the internet
- To provide basic design principles to present ideas, information, products, and services on websites
- To induce basic programming principles to the construction of websites

  To grasp the concepts on Java Beans, servlets, JSP
- To comprehend the connection between Relational Database and Java.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Design user interactions on web pages	K1, K2
2.	Develop back-end website applications	K1, K2
3.	Develop adaptive content for multiple devices (cell phone, tablets, etc.) Ensure cross-platform optimization for mobile phones	K2, K3
4.	Application of java beans, Servlets, JSP for designing Web based applications	K4, K5
5.	Usage of JDBC connectivity and implementation of the concept to get desired results from database	K6

K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create

Unit:1		18 hours

Introduction to Dynamic Web Content-Three-tier architecture-architecture for client- server applications-Introduction to HTML5-Structural Elements-Paving the Way for Web Applications:HTML5 forms-The HTML5 Canvas-Audio and VideoIntroduction to CSS- Advanced CSS with CSS3

Unit:2		18 hours

Accessing CSS from JavaScript Exploring JavaScript-Expressions and Control Flow in JavaScript-JavaScript Functions, Objects, and Arrays - HTML DOM – Modules – Forms – Includes – AJAX – Views – Scopes – Services -Dependency Injection - Custom Directives

Unit:3		18 hours

Introduction to CGI - Understanding Environment Variables - Disadvantages and Limitations of CGI - Servlet as an improved CGI - Servlet Fundamentals / API - What is a Web- Container - Servlet Life Cycle / Architecture - HTTP GET and POST Request Methods - Processing Html Forms - Init Parameters - State Management - Using HTTP Session - Cookies session tracking

Unit:4		**18 hours**

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean - JSP Architecture - JSP Standard / Implicit Objects - Request - Response - Out - config - Application - Session - Page - Page Context - exception - JSP Page Implementation Class - JSP Basics & Syntax - JSP Directive Tags - Page Directive - Include Directive - Taglib Directive - JSP Action Tags- Forward Action Tag- Include Action Tag- JSP Script related Tags- Scriptlet Tag- Expression Tag- Declaration Tag - Using Java Beans from JSP - UseBean Tag - setProperty Tag- getProperty Tag

Unit:5		**18 hours**

Network Programming: Working with URLs- Working with Sockets - Remote Method Invocation. Introduction to Database Management Systems - Tables, Rows, and Columns - Introduction to the SQL SELECT Statement - Inserting Rows - Updating and Deleting Existing Rows - Creating and Deleting Tables - Creating a New Database with JDBC - Scrollable Result Sets.

	Total Lecture hours	**90 hours**

Text Books

1	Java 6 Programming, Black Book, Dreamtech
2	Java Server Programming, Java EE6 (J2EE 1.6), Black Book, Dreamtech
3	Advanced Java Technology, By M.T. Savaliya, Dreamtech

ReferenceBooks

1	Herbert Schildt, "Java the Complete Reference", 10th edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2	Tony Goddis, "Starting out with Java from Control Structures Through Objects" 6th Edition, Pearson Education Limited, 2016
3	Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
4	John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi,2012.

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		Software Testing	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

To study fundamental concepts in software testing
To discuss various software testing issues and solutions in software unit test, integration and system testing.
To study the basic concept of Data flow testing and Domain testing.
Deduce Domain testing and syntax testing metrics and state graph methodologies.
Device verification and validation tools for various levels of testing for software products such win runner tool.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Students learn to apply software testing knowledge and engineering methods	K1
2	Have an ability to identify the needs of software test Automation, and define and develop a test tool to support test automation.	K2
3	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	K3, K4
4	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems	K4, K5
5	Have an ability to use software testing methods and modern software testing tools for their testing projects.	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	**12 hours**

Purpose of testing – Testing versus Debugging – Designer versus Tester – Modularity versus Efficiency – Model for testing – Taxonomy for bugs.

Unit:2	**12 hours**

Path testing basics – Predicates, path predicates and achievable paths – Path sensitizing – Path instrumentation – Implementation and application of path testing – Transaction flows – Transaction flow testing techniques.

Unit:3	**12 hours**

Data flow testing basics – Data flow testing strategies – Domains and paths – Domains testing – Domains and interface testing – Path product and path expressions – Reduction procedure.

Unit:4	**12 hours**

A grammar for formats – Test case generation – Implementation and application – Decision tables – State graphs – State testing.

Unit:5		12 hours
Strategies for programmers – Strategies for independent testers – Tests as software product – JUnit – Pytest.		
	Total Lecture hours	**60 hours**

Text Books	
1	B.Beizer,"SoftwareTestingTechniques",IIEdn.,DreamTechIndia,NewDelhi,2003.
2	K.V.K.Prasad,"SoftwareTestingTools",DreamTech.India,NewDelhi,2005
Reference Books	
1.	I.Burnstein,2003,"PracticalSoftwareTesting",SpringerInternationalEdn.
2.	E. Kit, 1995, "Software Testing in the Real World: Improving the Process", PearsonEducation,Delhi.
3.	R. Rajani,andP.P.Oak,2004,"SoftwareTesting",TataMcgrawHill,New Delhi.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1.	https://www.javatpoint.com/software-testing-tutorial
2.	https://www.guru99.com/software-testing.html

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	*S*	S	M	*S*
CO2	S	S	S	S	S	S	S	S	*S*	L	M	*S*
CO3	S	S	M	S	S	S	S	S	*S*	M	M	*S*
CO4	M	S	M	M	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	L	L	L	L	M	M	L

S- Strong; M-Medium; L-Low

Course code		Computer Vision	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

Understanding the Basics of Computer Vision.

Acquiring skills to develop computer vision-based applications.

To introduce students the fundamentals of image formation

To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition

To develop an appreciation for various issues in the design of computer vision and object recognition systems

To provide the student with programming experience from implementing computer vision and object recognition applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Ability to understand the computer vision pipeline. Ability to build solutions using computer vision algorithms.	K1, K2
2.	Identify basic concepts, terminology, theories, models and methods in the field of computer vision	K2, K3
3.	Describe known principles of human visual system	K4
4.	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition	K4, K5
5.	Suggest a design of a computer vision system for a specific problem	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		12 hours

Cameras - Pinhole Cameras - Cameras with Lenses - The Human Eye - Sensing Geometric Camera Models - Elements of Analytical Euclidean Geometry - Camera Parameters & Perspective projection - Affine Cameras and Affine Projection equations

Unit:2		12 hours

Geometric Camera Calibration - Least squares parameter estimation - A Linear Approach to Camera Calibration - Taking Radial Distortion into Account - Analytical Photogrammetry - Radiometry - Light in Space - Light at Surfaces -

Unit:3		12 hours

Sources, Shadows and shading - Qualitative Radiometry - Sources and Their Effects - Local Shading Model - Color- The Physics of Color - Human Color Perception - Representing Color - Surface Color from Image Color

Unit:4		**12 hours**
Linear filters - Convolution - Shift Invariant Linear Systems - Spatial Frequency and Fourier Transforms- Sampling and Aliasing - Scale and Image Pyramids		
Unit:5		**12 hours**
Edge detection - Noise - Detecting Edges - Texture - Representing Texture - Analysis (and Synthesis) Using Oriented Pyramids - Synthesizing Textures for Rendering- Shape from Texture for Planes		
	Total Lecture hours	**60 hours**

Text Books

1	D. Forsyth and J. Ponce; Computer Vision - A modern approach; Pearson India;2015

Reference Books

1	Richard Szeliksy "Computer Vision: Algorithms and Applications"
2	Haralick& Shapiro, "Computer and Robot Vision", Vol II
3	G_erardMedioni and Sing Bing Kang "Emerging topics in computer vision"
4	Emanuele Trucco and AllessandroVerri "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998
5	Olivier Faugeras, "Three-Dimensional Computer Vision", The MIT Press, 1993

Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]

1	https://www.youtube.com/watch?v=3LaVxEX3F0o&list=PLwdnzlV3ogoVsma 5G mBSsgJM6gHv1QoAo

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	L	S	M	L	M	L	L
CO2	S	S	M	L	M	L	M	L	M	S
CO3	S	S	L	M	S	S	L	M	L	M
CO4	M	L	S	M	M	L	S	L	M	S
CO5	S	S	L	S	L	M	L	M	M	L

S-Strong M-Medium L-Low

Course code		Artificial Neural Networks and Deep Learning	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

To understand the theoretical foundations, algorithms and methodologies of Neural Network

To design and develop an application using specific deep learning models

To provide practical knowledge in handling and analyzing real world applications.

To recognize the characteristics of deep learning models that are useful to solve real-world problems.

To introduce Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Understand different methodologies to create applications using deep nets.	K1, K2
2.	Identify and apply appropriate deep learning algorithms for analyzing the data for a variety of problems.	K2, K3
3.	Implement different deep learning algorithms	K3, K4
4.	Design the test procedures to assess the efficacy of the developed model.	K4, K5
5.	Combine several models in to gain better results	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		12 hours

Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks Feedforward neural networks: Pattern classification using perceptron, Multilayer feedforward neural networks (MLFFNNs), Backpropagation learning, Empirical risk minimization, Regularization, Autoencoders

Unit:2		12 hours

Deep neural networks (DNNs): Difficulty of training DNNs, Greedy layer wise training, Optimization for training DNNs, Newer optimization methods for neural networks (AdaGrad, RMSProp, Adam), Second order methods for training, Regularization methods (dropout, drop connect, batch normalization)

Unit:3		12 hours

Convolution neural networks (CNNs): Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, PlacesNet, training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs.

Unit:4		12 hours
Recurrent neural networks (RNNs): Sequence modeling using RNNs, Backpropagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture - Generative models: Restricted Boltzmann Machines (RBMs), Stacking RBMs, Belief nets.		
Unit:5		**12 hours**
Learning sigmoid belief nets, Deep belief nets Under complete - Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders. Applications: Applications in vision, speech and natural language processing		
	Total Lecture hours	**60 hours**

Text Books	
1	S. Haykin, Neural Networks and Learning Machines , Prentice Hall of India, 2016
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017
Reference Books	
1	Satish Kumar, Neural Networks - A ClassRoom
2	B. Yegnanarayana, Artificial Neural Networks, Prentice- Hall of India, 1999
3	Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.youtube.com/watch?v=aPfkYu_qiF4&list=PLEAYkSg4uS Q1r 2XrJ_GBzzS6I-f8yfRU

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	L	S	M	L	M	L	L
CO2	S	S	M	L	M	L	M	L	M	S
CO3	S	S	L	M	S	S	L	M	L	M
CO4	M	L	S	M	M	L	S	L	M	S
CO5	S	S	L	S	L	M	L	M	M	L

S-Strong M-Medium L-Low

Course code		MULTIMEDIA AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite		Basics of Multimedia				

Course Objectives:

The main objectives of this course are to:

1. To introduce the students the concepts of Multimedia, Images &Animation.
2. To introduce Multimedia authoring tools
3. To understand the role of Multimedia in Internet
4. To know about High Definition Television and Desktop Computing–Knowledge based Multimedia systems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic concepts of Multimedia	K1,K2
2	Demonstrate Multimedia authoring tools	K2,K3
3	Analyze the concepts of Sound, Images, Video & Animation	K4
4	Apply and Analyze the role of Multimedia in Internet and real time applications	K4,K5
5	Analyze multimedia applications using HDTV	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12 hours

What is Multimedia?–Introduction to making Multimedia–Macintosh and Windows Production platforms – Basic Software tools.

Unit:2	MULTIMEDIA TOOLS	12 hours

Making Instant Multimedia–Multimedia authoring tools–Multimedia building blocks–Text– Sound.

Unit:3	ANIMATION	10hours

Images–Animation–Video.

Unit:4	INTERNET	12 hours

Multimedia and the Internet–The Internet and how it works–Tools for World Wide Web–Designing for the World Wide Web.

Unit:5	MULTIMEDIA SYSTEMS	12 hours

High Definition Television and Desktop Computing –Knowledge based Multimedia systems.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Tay Vaughan, "Multimedia making it work",Fifth Edition, Tata McGraw Hill.
2	John F.KoegelBufford, "Multimedia Systems",Pearson Education.
ReferenceBooks	
1	Judith Jeffloate, "Multimedia in Practice (Technology and Applications)",PHI,2003.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.tutorialspoint.com/multimedia/index.htm
2	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm
3	https://nptel.ac.in/courses/117/105/117105083/

Mapping with Programming Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	M	M	M	S
CO2	S	S	S	S	M	S	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		EMBEDDED SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite		Basics of Micro Controller				

Course Objectives:

The main objectives of this course are to:

1. Present the introduction to 8051 Microcontroller Instruction Set, concepts on RTOS & Software tools.
2. Gain the knowledge about the embedded software development.
3. Learn about Microcontroller and software tools in the embedded systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concept of 8051 microcontroller	K1,K2
2	Understand the Instruction Set and Programming	K2,K3
3	Analyze the concepts of RTOS	K3,K4
4	Analyze and design various real time embedded systems using RTOS	K5
5	Debug the malfunctioning system using various debugging techniques	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**– Create

Unit:1	8051 MICRO CONTROLLER	12 hours

8051 Microcontroller : Introduction-8051 Architecture-Input / Output Pins, Port s and Circuits-External Memory - Counters / Timers - Serial Data Input / Output –Interrupts

Unit:2	PROGRAMMING BASICS	12 hours

Instruction Set and Programming Moving Data-Addressing Modes-Logical operations-Arithmetic Operation-Jump and Call Instructions-Simple Program. Applications: Keyboard Interface- Display Interface-Pulse Measurements-DIA and AID Conversions-Multiple Interrupts.

Unit:3	CONCEPTS ON RTOS	12 hours

CONCEPTS ON RTOS: Introduction to RTOS-Selecting an RTOS-Task and Task states - Tasks and data- Semaphores and shared data. MORE operating systems services: Interrupt Process communication - Message Queues, Mailboxes and pipes- Timer Functions-Events - Memory Management-Interrupt Routines in an RTOS Environment.

Unit:4	DESIGN USING RTOS	10Hours

Basic Design using a RTOS: Principles - Encapsulating semaphores and Queues-Hard real time scheduling considerations-Saving memory space and power- introductions to RTL &QNX.

Unit:5	SOFTWARE TOOLS	12 hours

SOFTWARE TOOLS : Embedded software Development Tools: Hostsand Target Machines-

Linker/Locators for Embedded software-getting Embedded software into the Target systems. Debugging Techniques: Testing on your Host machine -Instruction set simulators- The assert macro- using laboratory tools.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	David E.Simon,"An Embedded Software primer" Pearson Education Asia, 2003.
2	Kenneth J Ayala, "The 8051 Microcontroller and Architecture programming and application", Second Edition, Penram International.
Reference Books	
1	Raj Kamal, " Embedded Systems –Architecture, programming and design",TataMcGraw–Hill, 2003.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://onlinecourses.nptel.ac.in/noc20_cs14/preview
2	https://www.javatpoint.com/embedded-system-tutorial
3	https://www.tutorialspoint.com/embedded_systems/index.htm

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	L	L	L	S	M	S	S	M	M	S
CO2	M	M	S	S	M	S	M	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		Theory of Computation	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

To give an overview of the theoretical foundations of computer science from the perspective of formal languages
To illustrate finite state machines to solve problems in computing
To explain the hierarchy of problems arising in the computer sciences.
To familiarize Regular grammars, context frees grammar.
To use basic concepts of formal languages of finite automata techniques

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Use the concepts and techniques of discrete mathematics for theoretical computer science	K1 , K2
2	Design Finite Automata for different Regular Expressions and Languages	K2, K3
3	Identify and use different formal languages and their relationship.	K4
4	To solve various problems of applying normal form techniques, push down automata and Turing Machines	K5
5	Analyze various concepts of undecidability and Computable Function and Discuss analytically and intuitively for problem-solving situation	K5 , K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1 — **12 hours**

Review of Mathematical Theory
Combinatorics: Review of Permutation and Combination - Mathematical Induction - Pigeon hole principle - Principle of Inclusion and Exclusion - generating function - Recurrence relations.
Statements – Connectives – Truth Tables – Normal forms – Predicate calculus – Inference – Theory for Statement Calculus and Predicate Calculus

Unit:2 — **12 hours**

Regular Languages and Finite Automata
Regular Expressions, Regular Languages, Application of Finite Automata, Automata with output - Moore machine & Mealy machine, Finite Automata, Memory requirement in a recognizer, Definitions, union- intersection and complement of regular languages, Non Deterministic Finite Automata, Conversion from NFA to FA, ??- Non Deterministic Finite Automata, Conversion of NFA- ? to NFA, Kleene's Theorem, Minimization of Finite automata, Regular And Non Regular Languages – pumping lemma.

Unit:3 — **12 hours**

Context free grammar (CFG)
Definitions and Examples, Unions Concatenations And Kleene's of Context free language, Regular Grammar for Regular Language, Derivations and Ambiguity , Unambiguous CFG and Algebraic Expressions, Backus Naur Form (BNF), Normal Form – CNF

Unit:4		**12 hours**
Pushdown Automata, CFL And NCFL Definitions, Deterministic PDA, Equivalence of CFG and PDA & Conversion, Pumping lemma for CFL, Intersections and Complements of CFL, Non-CFL.		
Unit:5		**12 hours**
Turing Machine (TM) TM Definition, Model Of Computation, Turing Machine as Language Acceptor, TM that Compute Partial Function, Church Turing Thesis, Combining TM, Variations Of TM, Non Deterministic TM, Universal TM, Recursively and Enumerable Languages, Context sensitive languages and Chomsky hierarchy.		
	Total Lecture hours	**60 hours**

Text Books	
1	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman ; Introduction to Automata Theory Languages andComputation; Pearson Education, India; 3rd edition;2008
2	KENNETH H. ROSEN ; Discrete Mathematics and Its Applications (SIE) 8th Edition ;2021
Reference Books	
1	K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science Automata Languages and Computation, 2nd edition, Prentice Hall of India, India
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.youtube.com/playlist?list=PLbtzT1TYeoMjNOGEiaRmm_vMIwUAidnQz
2	https://nptel.ac.in/courses/10610604

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

Course code		Web Technology and Advanced Java Practical	L	T	P	C
Core/Elective/Supportive		Skill Enhancement			2	2
Pre-requisite						

Course Objectives:

- Learn how to create a program in java beans.
- Learn how to connect relational database to Java
- Develop the program using concepts servlets and JSP

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Implement Remote method invocations.	K1, K2
2.	Apply servlet in web applications	K2, K3
3.	Develop Servlets for creating Web based applications using JDBC.	K3, K4
4.	Develop JSP for creating Web based applications using JDBC.	K5
5.	Test java beans and session tracking	K5, K6

K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create

LISTOF PROGRAMS	30 hours

1. Create a simple calculator application that demonstrates the use of RMI. You are not required to create GUI.
2. Create Servlet That Prints Hello World.
3. Create Servlet That Prints Today's Date
4. Create Servlet for login page, if the username and password is correct then prints message "Hello username" else a message" login failed".
5. Create Servlet that uses cookies to store the number of times a user has visited the servlet.
6. Create a Servlet for demo of KBC game.
7. There will be continuous two or three pages with different MCQs. Each correct answer
8. carries Rs. 10000. At the end as per user's selection of answers total prize he won should be declared. User should not be allowed to backtrack.
9. Create a Servlet filter that calculates server's response time and add it to response when giving it back to client.
10. Create a jsp that prints hello world.
11. Create jsp that prints current date and time.
12. Create a jsp that add and subtract two numbers.
13. Create a jsp for login module.

14. Create a web page that prints 1 to 10 using JSTL 15. Create a custom JSP tag that prints current date and time. Use this tag into JSP page.	
Total Lecture hours	**30 hours**
Text Books	
1	Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press
2	JDBC, Servlets, and JSP, New Edition, Santhosh Kumar K , Kogent Learning Solutions Inc, Dreamtech Press
Reference Books	
1	.Java Server Pages, Pekowsky, Pearson.
2	Web Technologies , Uttam K. Roy, Volume 2 , Oxford University

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	S	S	S	S	M	M	M	M
CO2	S	S	S	S	S	S	S	S	S	S	M	M
CO3	S	S	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

Fifth Year

Semester –IX

Course code		**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core**	5			4
Pre-requisite		Basics of Image Processing				

Course Objectives:

The main objectives of this course are to:

1. Learn basic image processing techniques for solving real problems.
2. Gain knowledge in image transformation and Image enhancement techniques.
3. Learn Image compression and Segmentation procedures.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the fundamentals of Digital Image Processing	K1,K2
2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement	K2,K3
3	Apply, Design and Implement and get solutions for digital image processing problems	K3,K4
4	Apply the concepts of filtering and segmentation for digital image retrieval	K4,K5
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	**INTRODUCTION**	**15 hours**

Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.

Unit:2	**IMAGE ENHANCEMENT**	**15 hours**

Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.

Unit:3	**IMAGE RESTORATION**	**15 hours**

mage Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.

Unit:4	**IMAGE COMPRESSION**	**15 hours**

Image Compression: Fundamentals–Image compression models–Elements of Information Theory – Error Free compression – Lossy compression – Image compression standards.		
Unit:5	**IMAGE SEGMENTATION**	**13 hours**
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**75 hours**

	Text Books
1	Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Second Edition, PHI / Pearson Education.
2	B.Chanda, D. Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2003.
	Reference Books
1	Nick Efford, "Digital Image Processing a practical introducing using Java", Pearson Education, 2004.
	Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	M	S	M	M	S
CO2	S	S	S	S	S	M	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

S-Strong; M-Medium; L-Low

Course code		CLOUD COMPUTING	L	T	P	C
Core/Elective/Supportive		Core	5			4
Pre-requisite		Basics of Cloud & its Applications				

Course Objectives:

The main objectives of this course are to:

1. Gain knowledge on cloud computing, cloud services, architectures and applications.
2. Enable the students to learn the basics of cloud computing with real time usage
3. How to store and share, in and from cloud?

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of Cloud and its services	K1,K2
2	Collaborate Cloud for Event & Project Management	K3,K4
3	Analyzeon cloud in –Word Processing, Spread Sheets, Mail, Calendar, Database	K4,K5
4	Analyze cloud in social networks	K5,K6
5	Explore cloud storage and sharing	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12 hours

INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.

Unit:2	CLOUD COMPUTING	12 hours

CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloud computing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.

Unit:3	CLOUD SERVICES	12 hours

USING CLOUD SERVICES Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.

Unit:4	OUTSIDE THE CLOUD	12 hours

OUT SIDE THE CLOUD Evaluating webmail services, Evaluating instant messaging, Evaluating web conference tools, creating groups on social networks, Evaluating online

Groupware, collaborating viablogs and wikis.

Unit:5	STORING AND SHARING	10hours

STORING AND SHARING Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.
Reference Books	
1	Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGraw Hill Education Private Limited, 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	S	M	S	M	S	M	M	M	S
CO2	M	S	M	S	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	M	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DIGITAL IMAGE PROCESSING Using Python	L	T	P	C
Core/Elective/Supportive		Elective			5	4
Pre-requisite		Basic Programming of Image Processing & an intro to Python				

Course Objectives:

The main objectives of this course are to:

1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques
2. To enable the students to learn the fundamentals of image compression and segmentation
3. To understand Image Restoration & Filtering Techniques
4. Implementation of the above using MAT LAB

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	To write programs in MAT LAB for image processing using the techniques	K1,K2
2	To able to implement Image Enhancements & Restoration techniques	K2,K3
3	Capable of usingCompression techniques in an Image	K3,K4
4	Must be able to manipulate the image and Segment it	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LISTOF PROGRAMS	75 hours

1. Implement Image enhancement Technique.
2. Histogram Equalization
3. Image Restoration.
4. Implement Image Filtering.
5. Edge detection using Operators (Roberts, Prewitts and Sobels operators)
6. Implement image compression.
7. Image Subtraction
8. Boundary Extraction using morphology.
9. Image Segmentation

Total Lecture hours	75 hours

Text Books

1. Rafael C.Gonzalez, Richard E.Woods,"Digital Image Processing",Second Edition, PHI / Pearson Education.
2. B.Chanda, D. Dutta Majumder," Digital Image Processing and Analysis",PHI, 2003.

Reference Books	
1	Nick Efford,“Digital Image Processing a practical introducing using Java”,Pearson Education, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		Cryptography	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Core**	4			3
Pre-requisite		Basic Data Structures& Algorithms				

Course Objectives:

- To learn the emerging concepts of cryptography and algorithms
- To defend the security attacks on information systems using secure algorithms and Authentication process
- To categorize and analyze the key concepts in network and wireless security
- To Infer the need of security to introduce strong cryptosystems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Analyze the cryptographic algorithms for information security.	K1, K2
2.	Identify the authentication schemes for membership authorization.	K2, K3
3.	Identify computer and network security threats, classify the threats and develop a security model for detect and mitigate the attacks.	K3, K4
4.	Identify the requirements for secure communication and challenges related to the secure web services	K4, K5
5.	Ability to identify the need of ethical and professional practices, risk management Using emerging security solutions.	K5, K6

K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create

Unit:1		**12 hours**
Introduction and Symmetric Key Cryptographic Systems : Introduction to Cryptography, Types of Attacks, Symmetric Key Cryptography, Data Encryption Standard (DES), Differential and Linear cryptanalysis, Advanced Encryption Standard(AES), Modes of operation, Stream Ciphers: Feedback shift registers, Stream ciphers based on LFSRs.		
Unit:2		**12 hours**
Asymmetric Key Cryptosystems: Applications of asymmetric Cryptosystems – RSA Rabin, Elgamal, Probabilistic Cryptosystems, Elliptic Curve Cryptography (ECC), Diffie- Hellman key exchange protocol, Chinese Remainder Theorem (CRT).		
Unit:3		**12 hours**
Data Integrity and Authentication: Message Authentication Code (MAC), Hash function properties, General model for iterated hash functions -MD5, Secure Hash algorithms, HMAC, Attacks on hash functions.		
Unit:4		**12 hours**
Digital Signature algorithm, Public key infrastructure: X. 509 digital certificate, Kerberos, Zero-Knowledge Protocol.		
Unit:5		**12 hours**
Advanced Cryptographic Techniques: Multiparty Computation and Secret Sharing, Introduction - Indistinguishability - Secret - Sharing Simulation - Based Security-Security against Active Corruption-BGW Protocol (Active, Honest Majority)- Homomorphic Encryption- Lattice Cryptography		
	Total Lecture hours	**60 hours**

Text Books

1	J. Katz and Y. Lindell, Introduction to Modern Cryptography. Chapman & Hall/CRC Press, 2014
2	W. Stallings, Cryptography and Network Security: Principles and Practice, 7th Ed. Pearson Publishers, 2017.
3	C. Paar and J Pelzl, Understanding Cryptography, Springer, 2010
4	Behrouz A. Forouzan, Cryptography and Network Security:6th Ed. McGraw Hill,2017
5	Dan Boneh and Victor Shoup, A Graduate Course in Applied Cryptography, Jan 2020

ReferenceBooks

1	Kaufman, Perlman and Speciner. Network Security: Private Communication in a Public World., 2 nd edition,2002 , Pearson Publishers (ISBN No.:978-01-3-04601- 96)
2	Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone,Handbook of Applied Cryptography,5th edition,2001,CRC Press,(ISBN No:0-8493-8523-7)
3	D. R. Stinson, Cryptography: Theory and Practice, 3 rd Ed. Boca Raton, FL: Chapman &Hall/CRC, 2005. (ISBN No.:978-1-58-488508-5)J. H. Silverman, A Friendly

4	Introduction to Number Theory, 4th Ed. Boston: Pearson, 2012. (ISBN No.:978-0- 321-81619-1)
5	Ronald Cramer, Ivan BjerreDamgård, JesperBuus Nielsen, "Secure Multiparty Computation and Secret Sharing", ISBN 9781107043053, Cambridge University Press, 2015
6	Philip N. Klein, "A Cryptography Primer-Secrets and Promises", ISBN 9781107603455, Cambridge University Press, 2014
Related Online Contents [MOOC, SWAYAM, NPTEL,Websitesetc.]	
1	https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	L	M	L	S
CO2	S	S	M	L	M	L	M	L	M	S
CO3	S	S	L	M	S	S	L	M	L	M
CO4	M	L	S	M	M	L	S	L	M	S
CO5	S	S	L	S	L	M	L	M	M	L

S-Strong M-Medium L-Low

Course code		Distributed Database Systems	**L**	**T**	**P**	**C**
Core/Elective/Supportive		**Elective**	4			3
Pre-requisite						

Course Objectives:

To introduction students to Distributed DBMS and associated problems.
To make students understand various algorithms and techniques for managing distributed database.
To understand theoretical and practical aspects of distributed database systems.
To study and identify various issues related to the development of distributed database system.
To make students understand Transaction Management & Compare various approaches to concurrency control in Distributed database

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Apply various fragmentation techniques given a problem	K1

2	Analyse and calculate the cost of enforcing semantic integrity control	K2, K3
3	Use the steps of query processing	K4
4	Apply optimization techniques are applies to Distributed Database	K4, K5
5	Apply effectively Query Optimization Algorithms	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		**12 hours**

Introduction: Distributed Data Processing, Distributed Database Systems, Promises of DDBSs, Complicating factors, Problem areas Overview of RDBMS: Concepts, Integrity, Normalization - Distributed DBMS Architecture: Autonomy, Distribution, Heterogeneity DDBMS Architecture – Client/Server, Peer to peer, MDBS

Unit:2		**12 hours**

Data Distribution Alternatives: Design Alternatives – localized data, distributed data Fragmentation – Vertical, Horizontal (primary & derived), hybrid, general guidelines, correctness rules Distribution transparency – location, fragmentation, replication Impact of distribution on user queries – No Global Data Dictionary (GDD), GDD containing location information Example on fragmentation

Unit:3		**12 hours**

Semantic Data Control: View Management, Authentication – database authentication, OS authentication, Access Rights, Semantic Integrity Control – Centralized &Distributed , Cost of enforcing semantic integrity - : Query Processing: Query Processing Problem, Layers of Query Processing Query Processing in Centralized Systems – Parsing & Translation, Optimization, Code generation, Example Query Processing in Distributed Systems – Mapping global query to local, Optimization,

Unit:4		**12 hours**

Optimization of Distributed Queries: Query Optimization, Centralized Query Optimization, Join Ordering Distributed Query Optimization Algorithms - Distributed Transaction Management & Concurrency Control: Transaction concept, ACID property, Objectives of transaction management, Types of transactions, Objectives of Distributed Concurrency Control, Concurrency Control anomalies, Methods of concurrency control, Serializability and recoverability, Distributed Serializability, Enhanced lock based and timestamp based protocols, Multiple granularity, Multi version schemes, Optimistic Concurrency Control techniques

Unit:5		**12 hours**

Distributed Deadlock & Recovery: Deadlock concept, Deadlock in Centralized systems, Deadlock in Distributed Systems – Detection, Prevention, Avoidance, Wait-Die Algorithm, Wound-Wait algorithm Recovery in DBMS - Types of Failure, Methods to control failure, Different techniques of recoverability, Write- Ahead logging Protocol, Advanced recovery techniques- Shadow Paging, Fuzzy checkpoint, ARIES, RAID levels, Two Phase and Three Phase commit protocols

	Total Lecture hours	**60 hours**

Text Books	
1	Ozsu; Principles of Distributed Database Systems; Springer; 4th edition;2020
Reference Books	
1	Rahimi &Haug; Distributed Database Management Systems;Wiley;2010
2	Distributed Database Systems, Chanda Ray, Pearson Publication
3	Sachin Deshpande; Distributed Databases; Dreamtech;2014
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.youtube.com/watch?v=dlBVWMdGhqw&list=PLUJ7JmcrTifBROW

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	S	S	M	L	M	L	S
CO2	S	M	S	L	M	L	M	L	M	S
CO3	S	S	L	M	S	S	L	M	L	M
CO4	M	L	S	M	M	L	S	L	M	S
CO5	S	S	M	S	L	M	L	M	S	L

S-Strong M-Medium L-Low

Course code		Fuzzy Logic	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

To understand the basic concept of Fuzzy logic
To learn the various operations on relation properties
To study about the membership functions
To learn about the Defuzzification and Fuzzy Rule-Based System
To learn the concepts of Applications of Fuzzy Logic

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basics of Fuzzy sets, operation and properties.	K1, K2
2	Apply Cartesian product and composition on Fuzzy relations and usethe tolerance and Equivalence relations.	K2
3	Analyze various fuzzification methods and features of membership Functions.	K2, K3
4	Evaluate defuzzification methods for real time applications.	K4
5	Design an application using Fuzzy logic and its Relations.	K5 , K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		12 hours

Introduction to Fuzzy Logic- Fuzzy Sets- Fuzzy Set Operations, Properties of Fuzzy Sets, Classical and Fuzzy Relations: Introduction-Cartesian Product of Relation-Classical Relations-Cardinality of Crisp Relation

Unit:2		12 hours

Operations on Crisp Relation-Properties of Crisp Relations-Composition Fuzzy Relations, Cardinality of Fuzzy Relations-Operations on Fuzzy Relations-Properties of Fuzzy Relations-Fuzzy Cartesian Product and Composition-Tolerance and Equivalence Relations ,Crisp Relation.

Unit:3		12 hours

Membership Functions: Introduction, Features of Membership Function, Classification of Fuzzy Sets, Fuzzification, Membership Value Assignments, Intuition, Inference, Rank Ordering.

Unit:4		12 hours

Defuzzification: Introduction, Lambda Cuts for Fuzzy Sets, Lambda Cuts for Fuzzy Relations, Defuzzification Methods, Fuzzy Rule-Based System: Introduction, Formation of Rules, Decomposition of Rules, Aggregation of Fuzzy Rules, and Properties of Set of Rules.

Unit:5		12 hours

Applications of Fuzzy Logic: Fuzzy Logic in Automotive Applications, Fuzzy Antilock Brake System-Antilock-Braking System and Vehicle Speed-Estimation Using Fuzzy Logic.		
	Total Lecture hours	**60 hours**
Text Books		
1	S. N. Sivanandam, S. Sumathi and S. N. Deepa-Introduction to Fuzzy Logic using MATLAB, Springer-Verlag Berlin Heidelberg 2007.	
Reference Books		
1.	Guanrong Chen and Trung Tat Pham- Introduction to Fuzzy Sets, Fuzzy Logic and Fuzzy Control Systems	
2.	Timothy J Ross , Fuzzy Logic with Engineering Applications	
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]		
1.	https://www.javatpoint.com/fuzzy-logic	
2.	https://www.guru99.com/what-is-fuzzy-logic.html	

Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	1	1
CO2	3	2	3	2	3	3
CO3	3	3	2	2	2	3
CO4	2	3	1	1	3	3
CO5	3	2	3	3	3	3
Weightage of course Contributed to each PSO	13	13	11	10	12	13

S-Strong-3 M-Medium-2 L-Low-1

Course code		MOBILE COMPUTING	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite		Basics of Mobile Communication				

Course Objectives:

The main objectives of this course are to:

1. Present the overview of Mobile computing, Applications and Architectures.
2. Describe the futuristic computing challenges.
3. Enable the students to learn the concept of mobile computing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the need and requirements of mobile communication	K1,K2
2	Focus on mobile computing applications and techniques	K2,K3
3	Demonstrate satellite communication in mobile computing	K4
4	Analyze a bout wireless local loop architecture	K5,K6
5	Analyze various mobile communication technologies	K6

K1-Remember;**K2**-Understand;**K3**-Apply; **K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12 hours

Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.

Unit:2	MOBILE COMMUNICATION	12 hours

Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.

Unit:3	MOBILE COMPUTING	12 hours

Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.

Unit:4	MOBILE COMMUNICATION SYSTEM	12 hours

Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.

Unit:5	COMMUNICATION TECHNOLOGY	12 hours

WCDMA Technology and Fiber Optic Microcellular Mobile Communication – Ad hoc Network and Bluetooth technology – Intelligent Mobile Communication system – Fourth Generation Mobile Communication systems.

Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars–webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	T.G.Palanivelu, R.Nakkeeran,"Wireless and Mobile Communication",PHI Limited, 2009.
2	Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2007.
Reference Books	
1	Asoke K Talukder, Hasan Ahmed, RoopaYavagal,"Mobile Computing", TMH, 2010.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.tutorialspoint.com/mobile_computing/index.htm
2	https://www.javatpoint.com/mobile-computing
3	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	L	L	M	S	M	M	M	M
CO2	S	S	S	M	M	S	M	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		Principles of Complier Design	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite						

Course Objectives:

To learn the various phases of compiler.
To learn the various parsing techniques.
To understand intermediate code generation and run-time environment.
To learn to implement the front-end of the compiler.
To learn to implement code generators.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Understand the different phases of the compiler.	K1, K2
2.	Design a lexical analyzer for a sample language.	K2
3.	Apply different parsing algorithms to develop the parsers for a given grammar.	K3
4.	Design and implement a scanner and a parser using LEX and YACC tools	K4 , K5
5.	Learn to implement code optimization techniques and a simple code generator.	K5 , K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		12 hours

INTRODUCTION TO COMPILERS: Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

Unit:2		12 hours

SYNTAX ANALYSIS: Role of Parser – Grammars – Error Handling – Context free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser- LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

Unit:3		12 hours

INTERMEDIATE CODE GENERATION: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

Unit:4		12 hours

RUN-TIME ENVIRONMENT AND CODE GENERATION: Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator

Unit:5		**12 hours**
CODE OPTIMIZATION: Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.		
	Total Lecture hours	**60 hours**

Text Books	
1	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools; Pearson Education; Second Edition; 2013
Reference Books	
1.	Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2.	Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3.	Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4.	V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
5.	Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, 1993.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1.	https://www.youtube.com/watch?v=k4QXWFZZq1E&list=PLENQMW_c1dimx H Uu6KjuBC2rOlAaoLozF

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	L	S	M
CO2	S	M	S	S	S	M
CO3	S	S	L	M	S	S
CO4	M	L	S	M	M	L
CO5	S	S	M	S	L	M

S-Strong M-Medium L-Low

Course code		BLOCK CHAIN TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Elective	4			3
Pre-requisite		Basics of Block Chain & Crypto Currency				

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of block chain and crypto currency.
2. Understand the influence and role of block chain in various other fields.
3. Learn security features and its significance.
4. Identify problems & challenges posed by Block Chain.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate block chain technology and crypto currency	K1,K2
2	Understand the mining mechanism in block chain	K2
3	Apply and identify security measures, and various types of services that allow people to trade and transact with bit coins	K3,K4
4	Apply and analyze Block chain in healthcare industry	K4,K5
5	Analyze security, privacy, and efficiency of a given Block chain system	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1	INTRODUCTION	12 hours

Introduction to Block chain - The big picture of the industry – size, growth, structure, players. Bit coin versus Crypto currencies versus Block chain - Distributed Ledger Technology (DLT). Strategic analysis of the space – Block chain platforms, regulators, application providers. The major application: currency, identity, chain of custody.

Unit:2	NETWORK AND SECURITY	12 hours

Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, and Block chain 1.0, 2.0 and 3.0 – transition, advancements and features. Privacy, Security issues in Block chain.

Unit:3	CRYPTO CURRENCY	12 hours

Crypto currency - History, Distributed Ledger, Bit coin protocols -Symmetric-key cryptography - Public-key cryptography - Digital Signatures -High and Low trust societies - Types of Trust model: Peer-to-Peer, Leviathan, and Intermediary. Application of Cryptography to Block chain

Unit:4	CRYPTO CURRENCY REGULATION	12 hours

Crypto currency Regulation-Stakeholders, Roots of Bit coin, Legal views-exchange of crypto currency-Black Market-Global Economy. Cyrpto economics–assets, supply and

Demand, inflation and deflation – Regulation.		
Unit:5	**CHALLENGES IN BLOCK CHAIN**	**10 hours**
Opportunities and challenges in Block Chain – Application of block chain: Industry 4.0 – machine to machine communication –Datamanagementinindustry4.0–futureprospects.Block chain in Health 4.0 – Block chain properties - Healthcare Costs - Healthcare Quality - Healthcare Value - Challenges for using block chain for healthcare data		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Books	
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).
2	Antonopoulos, " Mastering Bitcoin: Unlocking Digital Cryptocurrencies"
ReferenceBooks	
1	Satoshi Nakamoto,"Bitcoin:APeer-to-PeerElectronicCashSystem"
2	Rodrigoda Rosa Righi,Antonio Marcos Alberti, Madhusudan Singh,"Blockchain Technology for Industry 4.0" Springer 2020.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]	
1	https://www.javatpoint.com/blockchain-tutorial
2	https://www.tutorialspoint.com/blockchain/index.htm
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/

Mapping with Programming Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		Robotic Process Automation for Business	L	T	P	C
Core/Elective/Supportive		Core Industry Module	3			3
Pre-requisite						

Course Objectives:

- Learn the concepts of RPA, its benefits, types and models.
- Gain the knowledge in application of RPA in Business Scenarios.
- Identify measures and skills required for RPA

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1.	Demonstrate the benefits and ethics of RPA	K1, K2
2.	Understand the Automation cycle and its techniques	K2
3.	Draw inferences and information processing of RPA	K3, K4
4.	Implement & Apply RPA in Business Scenarios	K5
5.	Analyze on Robots & leveraging automation	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		9 hours

IntroductiontoRPA –Overview of RPA –Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA –Centre of Excellence –Types and their applications –Building an RPA team-Approach for implementing RPA initiatives.

Unit:2		9 hours

Role of a Business Manager in Automation initiatives – Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.

Unit:3		9 hours

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows

Unit:4		9 hours
Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behaviour - Understand the skill of drawing inference or establishing causality by tracking the behaviour of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.		
Unit:5		**7 hours**
Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behaviour of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.		
Unit:6	**Contemporary Issues**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**45 hours**

	Text Books
1	Alok Mani Tripathi" Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool" Packt Publishing Limited March 2018.
2	TomTaulli"TheRoboticProcessAutomationHandbook" Apress,February2020.
	Reference Books
1	Steve Kaelble "Robotic Process Automation" John Wiley &Sons, Ltd., 2018
	Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]
1	https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.htm
2	https://www.javatpoint.com/rpa
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		CLOUD COMPUTING LAB	L	T	P	C
Core/Elective/Supportive		Skill Enhancement			2	2
Pre-requisite		Basic Programming using Cloud				

Course Objectives:

The main objectives of this course are to:

1. This course covers the basic data structures like Stack, Queue, Tree, and List.
2. This course enables the students to learn the applications of the data structures using various techniques
3. It also enable the students to understand C++ language with respect to OOAD concepts
4. Application of OOPS concepts

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of object oriented with respect to C++	K1,K2
2	Able to understand and implement OOPS concepts	K3,K4
3	Implementation of data structures like Stack, Queue, Tree, List using C++	K4,K5
4	Application of the data structures for Sorting, Searching using different techniques.	K5,K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

LIST OF PROGRAMS	30 hours

1. Working with Google Drive to make spreadsheet and notes.
2. Launch a Linux Virtual Machine.
3. To host a static website
4. Exploring Google cloud for the following a)Storage b)Sharing of data c)manage your calendar, to-do lists, d) a document editing tool
5. Working and installation of Google App Engine
6. Working and installation of Microsoft Azure
7. To Connect Amazon Red shift with S3 bucket
8. To Create and Query a No SQL Table

Expert lectures, online seminars–webinars

Total Lecture hours	60 hours

Text Books

1	Michael Miller, “Cloud Computing”, Pearson Education, New Delhi, 2009.

Reference Books

Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGraw Hill Education Private Limited, 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websitesetc.]

https://nptel.ac.in/courses/106/105/106105167/

https://www.tutorialspoint.com/cloud_computing/index.htm

Mapping with Programming Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	S	S	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Semester -X

Course code		MOBILE APPLICATION DEVELOPMENT	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite						

Course Objectives:

To provide the students with the basics of Android Programming
To gain knowledge on Software Development tools for Mobile Applications
Development of software on mobile platform for Real Time use

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Chart the requirements needed for developing android application	
2	Identify the results by executing the application in emulator or in android device	
3	Apply proper interface setup, styles & themes, storing and management	
4	Analyze the problem and add necessary user interface components, graphics and multimedia components into the application.	
5	Evaluate the results by implementing the concept behind the problem with proper code.	

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		**18 hours**

Introduction to Android Operating System –Configuration of Android Environment-Create the Fir Android Application .Layout: Vertical, Vertical Scroll, horizontal, horizontal Scroll, Table Layou arrangement. **Designing User Interface:** Label Text – Text View – Password Text Box - Button Image Button– Check Box– Image – Radio Button – Slider – Autocomplete text View.

Unit:2		**18 hours**

User Interface: Spinner–Switch – Side Bar-List View - List Picker -Image Picker - Notifier-Time and Date Picker - Web Viewer

Unit:3		**18 hours**

Media: Camcorder - Camera – Player – Speech Recognizer – Text to Speech – Video Player – Canvas

Unit:4		**18 hours**

Maps: Maps - Sensor: Location Sensor – Barcode Scanner Social components: Contact Picker – Ema Picker – Phone Number Picker – Phone Call - Social: Texting

Unit:5		**18 hours**
Storage: Cloud DB – Tiny DB – Experimental – Fire DB		
	Total Lecture hours	**90 hours**
Text Books		
1	Karen Lang and Selim Tezel, (2022), Become an App Inventor The official guide from MIT App Inventor, Miteen Press, Walker Books Limited.	
Reference Books		
1	Wei – Meng Lee, (2012), Beginning Android 4 Application Development, Wiley India Edition.	
2	Deital, Android for Programmers-An App-Driven Approach,Second Edition.	
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]		
1	http://ai2.appinventor.mit.edu/reference/	
2	http://appinventor.mit.edu/explore/paint-pot-extended-camera	

MAPPING TABLE						
CO/PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**2**	**3**	**2**	**2**
CO3	**3**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**
Weightageofcoursecontributedtoeach PSO	**14**	**13**	**14**	**14**	**14**	**13**

S-Strong-3 M-Medium-2 L-Low-1

Course code		MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
Core/Elective/Supportive		Core			6	4
Pre-requisite						

Course Objectives:

Learning Objectives:

To explain user defined functions and the concepts of class.
To demonstrate the creation cookies and sessions
To facilitate the creation of Database and validate the user inputs

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of counter and dialogs.	K15 , K6
2	Concepts of Layout Managers. Perform sending email on audio and video To enable the applications of audio and video.	K2
3	To apply Local File Storage and Development of files.	K3
4	To determine the concepts of Simple Animation To apply searching pages.	K4, K5
5	Usage of Student mark sheet- preparation in MAD. Concepts of processing Sqlite are implemented.	K

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		90 hours

1. Develop an application for Simple Counter.
2. Develop an application to display your personal details using GUI Components.
3. Develop a Simple Calculator that uses radio buttons and text view.
4. Develop an application that uses Intent and Activity.
5. Develop an application that uses Dialog Boxes.
6. Develop an application to display a Splash Screen.
7. Develop an application that uses Layout Managers.
8. Develop an application that uses different types of Menus.
9. Develop an application that uses to send messages from one mobile to another mobile.
10. Develop an application that uses to send E-mail. Develop an application that plays Audio and Video.
11. Develop an application that uses Local File Storage.
12. Develop an application for Simple Animation.
13. Develop an application for Login Page using Sqlite.
14. Develop an application for Student Marksheet processing using Sqlite.

	Total Lecture hours	90 hours

Text Books	
1	T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
2	Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
Reference Books	
1	Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
2	Android Application Development All in one for Dummies by Barry Burd, Edition: I

Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO 1	3	3	3	3	3	2
CO 2	3	3	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	3	3	3	3	3	3
CO 5	3	3	3	3	3	3
Weightage of course contributed to each PSO	15	15	15	13	15	14

S-Strong-3 M-Medium-2 L-Low-1

Course code		Machine Learning	L	T	P	C
Core/Elective/Supportive		Core	6			4
Pre-requisite						

Course Objectives:

To provide mathematical base for Machine learning
To provide theoretical knowledge on setting hypothesis for pattern recognition.
To impart Knowledge of machine learning techniques for data handling
To provide the skill to evaluate the performance of algorithms and to provide solution for various real-world applications.
To impart the knowledge of identifying similarities and differences in various patterns of data

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Recognize the characteristics of machine learning strategies. Apply various supervised learning methods to appropriate problems.	K1
2	Identify and integrate more than one technique to enhance the performance of learning.	K2
3	Analyze the co-occurrence of data to find interesting frequent patterns.	K2, K3
4	Preprocess the data before applying to any real-world problem and can evaluate its performance.	K4, K5
5	Create probabilistic and unsupervised learning models for handling unknown pattern.	K5, K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1 **18 hours**

BASIC MATHEMATICS FOR MACHINE LEARNING: Regression Correlation and Regression, types of correlation – Pearson's, Spearman's correlations –Ordinary Least Squares, Fitting a regression line, logistic regression, Rank Correlation Partial and Multiple correlation- Multiple regression, multicollinearity. Gradient descent methods, Newton method, interior point methods, active set, proximity methods, accelerated gradient methods, coordinate descent, cutting planes, stochastic gradient descent. Discriminant analysis, Principal component analysis, Factor analysis, k means.

Unit:2 **18 hours**

INTRODUCTION TO MACHINE LEARNING: Introduction, Examples of various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning, VC Dimension.

Unit:3 **18 hours**

SUPERVISED LEARNING ALGORITHMS Learning a Class from Examples, Linear, Non-linear, Multi-class and Multi-label classification, Decision Trees: ID3, Classification and Regression Trees (CART), Regression: Linear Regression, Multiple Linear Regression, Logistic Regression. Neural Networks: Introduction, Perceptron, Multilayer Perceptron, Support vector machines: Linear and Nonlinear, Kernel Functions, K-Nearest Neighbors

Unit:4 **18 hours**

ENSEMBLE LEARNING: Ensemble Learning Model Combination Schemes, Voting, Error-Correcting Output Codes, Bagging: RandomForest Trees, Boosting: Adaboost, Stacking:

UNSUPERVISED LEARNING: Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal Component Analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis

Unit:5		**18 hours**
PROBABILISTIC LEARNING: Bayesian Learning, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks, Mining Frequent Patterns: MACHINE LEARNING IN PRACTICE: Design, Analysis and Evaluation of Machine Learning Experiments, Other Issues: Handling imbalanced data sets		
	Total Lecture hours	**90 hours**

Text Books	
1	EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
2	MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, 2012.
Reference Books	
1.	Tom Mitchell, "Machine Learning", McGraw Hill, 3 rd Edition,1997.
2.	Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1.	https://www.youtube.com/watch?v=r4sgKrRL2Ys&list=PL1xHD4vteKYVpaIiy295pg6_SY5qznc77

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO 1	S	S	M	S	M	L	M	S	L	L
CO 2	S	M	S	L	S	L	M	L	M	S
CO 3	M	S	L	M	M	S	L	S	L	S
CO 4	L	S	S	L	S	M	S	L	S	M
CO 5	S	L	M	S	L	L	M	S	M	S

S-Strong M-Medium L-Low

Course code		Quantitative Aptitude	L	T	P	C
Core/Elective/Supportive		Skill Enhancement	2			2
Pre-requisite		-				

Course Objectives:

To understand the basic concepts of numbers
Understand and apply the concept of percentage, profit & loss
To study the basic concepts of time and work, interests
To learn the concepts of permutation, probability, discounts
To study about the concepts of data representation, graphs

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	On completion of this course, students will	K1
2	understand the concepts, application and the problems of numbers	K1,K2
3	To have basic knowledge and understanding about percentage, profit & loss related processings	K3
4	To understand the concepts of time and work	K4, K5
5	Speaks about the concepts of probability, discount	K6

K1-Remember;**K2**-Understand;**K3**-Apply;**K4**-Analyze;**K5**-Evaluate; **K6**-Create

Unit:1		**6 hours**

Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers.

Unit:2		**6 hours**

Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.

Unit:3		**6 hours**

Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area - races and Games of skill.

Unit:4		**6 hours**

Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.

Unit:5		**6 hours**

Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs.

	Total Lecture hours	**30 hours**

Text Books	
1	"QuantitativeAptitude",R.S.AGGARWAL.,S.Chand&CompanyLtd.,
Reference Books	
1	General Quantitative Aptitude for Competitive Exams, Disha Experts
2	How to prepare for Quantitative Aptitude by Arun Sharma
Related Online Contents[MOOC, SWAYAM, NPTEL, Websitesetc.]	
1.	https://www.javatpoint.com/aptitude/quantitative
2.	https://www.toppr.com/guides/quantitative-aptitude/

Mapping with Programme Outcomes:

MAPPING TABLE						
CO/ PSO	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**
CO1	**3**	**2**	**1**	**2**	**2**	**2**
CO2	**2**	**3**	**1**	**3**	**2**	**2**
CO3	**1**	**3**	**1**	**1**	**3**	**1**
CO4	**1**	**2**	**1**	**1**	**3**	**1**
CO5	**1**	**2**	**1**	**1**	**3**	**3**
Weightage of course contributed to each PSO	**8**	**12**	**5**	**8**	**13**	**9**

S-Strong-3 M-Medium-2 L-Low-1