

**SRI SANKARA ARTS AND SCIENCE COLLEGE**

**(AUTONOMOUS)**

**ENATHUR, KANCHIPURAM – 631 561.**

**Learning Outcome-based Curriculum Framework**

**(LOCF)**

for

**B.SC., COMPUTER SCIENCE**

**Choice Based Credit System (CBCS)**

**REGULATIONS & SYLLABUS**

**(Effective from the academic year 2023 - 2024)**

**Choice Based Credit System**

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**Preamble:**

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

## 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 B.Sc. Computer Science programme aims to instill core competencies through introduction of basic and fundamental courses and along with corporate-savvy courses that trains the students to be corporate-ready. The curriculum is designed meticulously so as to enhance the employability skill, entrepreneurship skill, research-oriented skill and skill necessary for cracking the competitive exams. In particular, the course prepares the students to be employable as Web Developer, Software Engineer, Software Tester, Network Administrator, Database Administrator, Data Analyst.

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

- To acquire basic core competencies in fundamental subjects with good foundation in theory and its applications such as Data structures, Operating system, Database systems, Software Engineering, Algorithms, 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 B.Sc. CS Programme**

The undergraduate programs in Computer Science adds-on to the science-oriented knowledge gained in the higher secondary school education, which provides strong rooting in basic computation science and basic programming languages. This sets up the young students for a more rigorous theories and practices of the world of computer science.

Curriculum and syllabi framework is intended to introduce students to the foundation of computing along with core technologies and its applications. It is highly critical in inculcating a strong foundation in the fundamentals of computer science so as to venture into a diversified spectrum of applications of computer science. The curriculum in computer science is integrated with courses in the sciences and the humanities to offer foundation and allied courses to enhance student employment opportunities.

### **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:

- **Disciplinary knowledge:**

The graduate must demonstrate comprehensive and in-depth knowledge and understanding of the core concepts offered in the curriculum of Computer Science.

- **Communication skills:**

Since the scope for the employment for a computer science graduate has spawned over the world, it is pertinent that the graduates have good communication skills. They should confidently share one's view and express their ideas to the world. They should possess the ability to present the complex information in a precise, concise and unambiguous manner.

- **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 from 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.

- **Ethical Practices:**

Ethical practice is a key component of professionalism and needs to be instilled in curricula across courses. Ethical practices give the graduates a sense of discretion and moral responsibility for carrying out their duties in a diverse and fiercely competing society. It shall imbibe cultural diversity, linguistic differences and complex nature of our world.

- **Critical Thinking:**

Critical Thinking gives the capability to apply analytic thought to find a solution to a problem by analysing the problem, evaluating the evidences, identifying the path to the solutions, formulating the methods and procedures to the possible solutions.

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

**GA-1:** A commitment to excellence in all scholarly and intellectual activities, including critical judgement.

**GA-2:** Ability to engage constructively and methodically when exploring ideas, theories and philosophies.

**GA-3:** Ability to consider other points of view and make a thoughtful argument

**GA-4:** Commitment to sustainability and high ethical standards in social and professional practices.

**GA-5:** To be open-minded about cultural diversity, linguistic difference and the complex nature of our world.

**GA- 6:** Open to objective and constructive feedback from supervisors and peers.

### **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.

## **5. Qualification Descriptors for B.Sc. with CS**

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

**QD-1:** Fundamental understanding of the principles of Computer Science and its connections with other disciplines.

**QD-2:** Skills and tools in areas related to Computer Science and current development in Government and public service.

**QD-3:** Communicate the results of studies undertaken in Computer Science accurately in a range of different contexts using the main concepts, constructs and techniques.

**QD-4:** Apply Computer Science knowledge and transferable skills to new / unfamiliar contexts.

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

## 6. Programme Outcomes (PO) of B.Sc. degree programme in Computer Science

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

- Scientific aptitude will be developed in Students
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

PO1: Knowledge

PO2: Problem Analysis



PO3: Design / Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Modern tool usage

PO6: Applying to society

## 7. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and realtime application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to an Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PSO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PSO7: Equip with Computer science technical ability, problem solving skills, creative talent and power of communication necessary for various forms of employment.

PSO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PSO9: Get adequate exposure to global and local concerns that provides platform for further exploration into multi-dimensional aspects of computing sciences.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids: (put tick mark in each row)

PO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	✓					
PO2		✓				
PO3			✓			
PO4				✓		
PO5					✓	
PO6						✓

### 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

## **7.1 ELIGIBILITY FOR ADMISSION:**

Candidates for admission to the first year of the Degree of Bachelor of Science courses shall be required to have passed the Higher Secondary Examinations with a computer science / Mathematics conducted by the Government of Tamil Nadu or CBSE pattern shall be permitted to appear and qualify for the B.Sc Degree Examination of the University of Madras affiliated colleges of this University.

## **7.2 STRUCTURE OF THE COURSE**

The course is organized on semester basis with a total of six semesters. Each student will opt for a comprehensive, interactive course with one of the faculty member. The topic of specialization and course content will be determined by the dept/course advisor.

Core practical **Laboratory:** Independent system shall be provided for the each student. It is recommended that the practical training be organized as an exercise rather than simple demonstration. The student must actually perform the experiments.

## **7.3 ELIGIBILITY FOR THE AWARD OF DEGREE**

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 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.

## **7.4 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 the third and fourth semesters and the third academic year the fifth and sixth 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, Papers 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. One credit of each theory paper is equal to 15 hrs of lectures or 30 hrs of practical works.

## **7.5 MAXIMUM PERIOD FOR COMPLETION OF THEPROGRAMMES**

The candidates shall complete the B.Sc Degree Programmes within 6 years from the date of admission. The term completing the programmes means passing all the prescribed examinations of the programme to become eligible for the degree. No candidate shall be permitted to appear for the examinations after the prescribed period for completing the programme.

## **7.6 COURSE OF STUDY**

A Bachelor'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 Bachelor'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 TANSICHE (Advanced Tamil / Soft skill / Environmental Studies / Value education), and (v) Extension activities.

The detail of the Study for Bachelor 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 studied 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 UG degree Programme, a candidate must undergo a minimum of 4 papers (4 x 2 = 8 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.

#### **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 Compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 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 who complete 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 extension service activities. The working hours should not overlaps the normal teaching hours.

#### **Student advisor**

All teachers of the department shall function as student advisors. There will be more or less an equal number of students assigned to each student advisor of a department. The student advisor will help the students in choosing core and elective papers of study. The student advisor shall be responsible for registration of papers (subjects) by his students. The student advisor will offer all possible student support services

#### **7.7 CREDITS**

The term credit is used to describe the quantum of syllabus for various programmes in terms of periods of study. It indicates differential weightage given according to the content's duration of the courses in the curriculum design. The minimum credit requirement for a three-year Bachelor's programme shall be **140** credits. Each subject (course) is designed variously under lectures / tutorials / laboratory work / seminar / project work etc., to meet effective teaching and learning needs and credits are assigned suitably.

One credit for each lecture / tutorial / project work period per week shall be allotted. One credit for two laboratory hours per week shall be allotted. In practical, each credit should cover minimum of six experiments. Thus normally, in each of the subject, credits will be assigned on the basis of the lectures / tutorials / laboratory work / project work and other forms of learning in a 15-week schedule.

#### **7.8 SCHEME OF EXAMINATION**

There shall be continuous, comprehensive evaluation of students through internal and external examination. At least 2 internal examinations (Sessional Tests) per semester and 1 semester ending examination should be conducted.

**Sessional Test I** will be held during sixth week for syllabi covered till then. Sessional Test I will be a combination of a variety of tools such as class test, assignment, paper presentation etc., that would be suitable for the paper. This required an element of openness. The students are to be informed in advance about the nature of assessment and the procedures.

However, the tests are compulsory. Test I may be for one hour duration. The pattern of question paper will be decided by the respective board of studies.

Sessional Test I will carry 20% of marks of the entire paper.

**Sessional Test II** will be held during eleventh week for syllabi covered between seventh and eleventh weeks. Sessional Test I will be a combination of a variety of tools such as class test, assignment, paper presentation etc. that would be suitable for the paper. It will also have an element of openness. The students are to be informed in advance about the nature of assessment and the procedures. However, the tests are compulsory. Test II may be for one hour duration. The pattern of question paper will be decided by the respective board of studies.

Sessional Test II will carry 20% of marks of the entire paper.

There will be one End Semester examination of 2 - 3 hours duration in each paper. The End semester examination will cover all the syllabi of the paper for 60% of Marks.

A dissertation may be offered in lieu of one / two papers / practicals. It shall be evaluated by two examiners one external and one internal appointed by the Controller of Examination. Wherever there is viva-voce, it shall be conducted by the common Viva Board consisting of the Chairman and internal members of the Board of Examination in the concerned subject, internal guide and one external expert as approved by the Controller of Examinations.

End semester practical examinations shall be held before the theory examinations to benefit the students to undertake examinations of other departments.

Every course offered will have three components associated with the teaching-learning process of the course, namely (i) Lecture - L (ii) Tutorial - T (iii) Practicals - P, (iv) Self study - S where,

**L** stands Lecture session. **T** stands Tutorial session consisting participatory discussion / self-study / desk work / brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

**P** stands Practice session and it consists of Hands-on experience / Laboratory Experiments / Field Studies / Case studies that equip students to acquire the much required skill component.

**S** stands Self-study session consisting participatory discussion by student with the guidance of faculty. This session is not included in the weekly hour plan.

In terms of credits, every one-hour session of L amounts to 1 credit per semester, a minimum of two-hour session of T or P amounts to 1 credit per semester and no credits allotted to self-study hour, over a period of one semester of 15 weeks for teaching-learning process. The total duration of a semester is 20 weeks inclusive of semester-end examination.

A course shall have either or all the three components. That means a course may have only lecture component, or only practical component or combination of any two or all the three components. The total credits earned by a student at the end of the semester upon successfully completing the course are  $L + T + P + S$ . The credit pattern of the course is indicated as L: T: P: S. For example: a theory course with a L-T-P-S schedule of 4-0-0-2 will be assigned 4 credits, and a lab practical course with a L-T-P-S schedule of 0-0-3-0 will be assigned 3 credits.

For B.Sc. courses Part I, Part II and Part IV subjects will be provided to first to fourth semesters. In fifth and sixth semesters only part III papers provided. Total of 30 hrs. was to be maintained constantly for all semesters.

Total credits of 140 attained through three years of their study period.

### **Question Paper Pattern**

#### **SECTION – A ( 30 words)**

10 OUT OF 12    -10 X 2 marks            = 20 marks

#### **SECTION – B (200 words)**

5 out of 7            -5 x 5 marks            = 25 marks

#### **SECTION – C (500 words)**

3 out of 5            - 3x 10 marks            = 30 marks

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**TOTAL            =    75 marks**

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## 7.9 SCHEME OF EXAMINATIONS:

SUBJECTS	MAX. CREDITS	EXAM HRS	MAX. MARKS		
			Internal	External	TOTAL
<b>PART I</b> Language	3	3	25	75	100
<b>PART II</b> English	3	3	25	75	100
<b>PART III</b> Core Subject	5	3	25	75	100
Core Practical	5	3	40	60	100
Elective Paper	3	3	25	75	100
Elective Practical	3	3	40	60	100
<b>PART IV</b> 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-paper (level will be at 6th Standard).  (b) Those who have studied 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	2	25	75	100
2. Skill based subjects – Skill Enhancement course, Foundation course, Professional Competency course	2	2	50	50	100
<b>PART V – Extension activities</b>	1				
<b>TOTAL</b>	<b>27</b>				



The following procedure be followed for internal Marks

The number of working hours per week for the students for getting the **140** prescribed credits should not exceed 30 hours of class per week and no faculty member should be allocated extra hours beyond the prescribed 16 lecture hours.

**The following procedure be followed for Internal Marks**

**Theory Papers: Internal Marks 25**

**INTERNAL MARKS**

Tests (2 out of 3)	10
Attendance	5
Seminars	5
Assignments	5
<b>TOTAL</b>	<b>25</b>

**Break-up Details for Attendance**

Below 60%- No marks

60%	To	75%	- 3 marks
76%	To	90 %	- 4 marks
91%	To	100%	- 5 marks

<b>Practical</b>	<b>Internal Marks</b>	<b>40</b>
	Attendance	5 marks
2 out of 3	Practical Test best	30 marks
	Record	4 marks

## **7.10 REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER**

- i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.
- ii. Candidates shall be permitted to proceed from the First Semester up to 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 subject of earlier semesters along the current (subsequent) Semester Subjects.
- iii. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Academic Council from time to time. Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any extraordinary circumstances 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 Candidates 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 Academic Council from time to time.
- iv. There shall be examinations at the end of each semester, for odd semesters in the month of October / November, for even semesters in April / May. A candidate who does not pass the examination in any paper(s) shall be permitted to appear in such failed courses in the subsequent examinations to be held in October / November or April / May.
- v. The results of all the examinations will be published through the College website.

## **7.11 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 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. He/She shall also complete two certificate courses to qualify for the Degree.

## 7.12 CLASSIFICATION OF SUCCESSFUL CANDIDATES

### **PART- I TAMIL / OTHER LANGUAGES**

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

### **PART – II ENGLISH**

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

### **PART – III consisting of CORE SUBJECTS, ELECTIVE (Generic / Discipline Specific) SUBJECTS, PROJECT with**

three papers: Successful candidates passing the examinations for Core papers together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core papers together shall be declared to have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the THIRD Class.

### **PART – IV consisting of sub items 1 (a), (b) & (c), 2, 3 and 4**

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

### **PART – V EXTENTION ACTIVITIES**

Successful Candidate earning of 1 credit for extension activities SHALL NOT BE taken into consideration for Classification / Ranking / Distinction.

### **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 8(iii) category are only eligible for Classification.

**7.13 GRADING SYSTEM:**

1. Passing Minimum is 40% of the ESE and also 40% of the maximum of that paper/course.
2. Minimum Credits to be earned:

For THREE-Year-Programme: Best 140 Credits  
 (Part I and II: Languages, Part III Major, Elective, Part –IV Soft skills and Part V: Extension activities)

3. Marks and Grades:

The following table gives the marks, grade points, letter grades and classification to indicate the performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade (Performance in a Course /Paper )

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90–100	9.0–10.0	O	Outstanding
80–89	8.0–8.9	D+	Excellent
75–79	7.5–7.9	D	Distinction
70–74	7.0–7.4	A+	Very Good
60–69	6.0–6.9	A	Good
50–59	5.0–5.9	B	Average
40–49	4.0–4.9	C	Satisfactory
00–39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

C<sub>i</sub> = Credits earned for course-i in any semester.  
 G<sub>i</sub> = Grade Point obtained for course- i in any semester.  
 n refers to the semester in which such courses were credited.

For a Semester:

**GRADE POINT AVERAGE [GPA] =  $\sum_i C_i G_i / \sum_i C_i$**

Sum of the multiplication of grade points by the credits of the courses

**GPA =** .....

Sum of the credits of the courses in a semester

For the entire programme:

$$\text{CUMULATIVE GRADE POINT AVERAGE [CGPA]} = \frac{\sum n \sum i C_i n_i G_i}{\sum n \sum C_i n_i}$$

Sum of the multiplication of grade points by the credits of the entire programme

$$\text{CGPA} = \frac{\text{-----}}{\text{Sum of the credits of the courses of the entire programme}}$$

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5-10.0	O+	First Class - Exemplary *
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction *
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.5 and above but below 5.0	C+	Third Class
4.0 and above but below 4.5	C	
0.0 and above but below 4.0	U	Re-appear

\* The candidates who have passed in the first appearance and within the prescribed semester of the UG Programme (Major, Allied and Elective courses alone) are eligible.

#### **7.14 TRANSITORY PROVISION**

Candidates who have undergone the course of study prior to the academic year 2022-2023 will be permitted to appear for the examinations under those Regulations for a period of TWO years i.e. upto and inclusive of April - May 2025 Examinations. Thereafter, they will be permitted to appear for the examination only under the Regulations then in force.

## **8. Highlights of the Revamped Curriculum**

- 8.1 Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- 8.2 The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- 8.3 The General Studies and Computer Science based problem solving skills are included as mandatory components in the ‘\_Training for Competitive Examinations’ course at the final semester, a first of its kind
- 8.4 The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- 8.5 The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- 8.6 The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- 8.7 Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- 8.8 State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest – Statistics with R Programming, Data Science, Machine learning. Internet of Things and Artificial Intelligence etc...

## 9. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	<b>Foundation Course</b> To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	<ul style="list-style-type: none"> <li>• Instil confidence among students</li> <li>• Create interest for the subject</li> </ul>
I, II, III, IV	<b>Skill Enhancement papers</b> (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> <li>• Industry ready graduates</li> <li>• Skilled human resource</li> <li>• Students are equipped with essential skills to make them employable</li> </ul>
		<ul style="list-style-type: none"> <li>• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects</li> </ul>
		<ul style="list-style-type: none"> <li>• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> </ul>
		<ul style="list-style-type: none"> <li>• Entrepreneurial skill training will provide an opportunity for independent livelihood</li> <li>• Generates self – employment</li> <li>• Create small scale entrepreneurs</li> <li>• Training to girls leads to women empowerment</li> </ul>
		<ul style="list-style-type: none"> <li>• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools</li> </ul>
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	<ul style="list-style-type: none"> <li>• Strengthening the domain knowledge</li> <li>• Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>• Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background</li> <li>• Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective</li> </ul>



		Sectors
IV	Industrial Statistics	<ul style="list-style-type: none"> <li>• Exposure to industry moulds students into solution providers</li> <li>• Generates Industry ready graduates</li> <li>• Employment opportunities enhanced</li> </ul>
II year Vacation activity	Internship / Industrial Training	<ul style="list-style-type: none"> <li>• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.</li> </ul>
VI Semester	Project with Viva – voce Introduction of	<ul style="list-style-type: none"> <li>• Self-learning is enhanced</li> <li>• Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>
	Professional Competency component	<ul style="list-style-type: none"> <li>• Curriculum design accommodates all category of learners; ‘_Mathematics for Advanced Explain’ component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers;</li> <li>• ‘_Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.</li> </ul>
Extra Credits:  For Advanced Learners / Honors degree		<ul style="list-style-type: none"> <li>• To cater to the needs of peer learners / research aspirants</li> </ul>

<b>Skills acquired from the Courses</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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### Credit Distribution for UG Programmes

Sem I	Cre dit	H	Sem II	Cre dit	H	Sem III	Cre dit	H	Sem IV	Cre dit	H	Sem V	Cre dit	H	Sem VI	Cre dit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course –\CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva- voce CC –XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective v Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement - (Foundation Course)	2	2	2.7 Skill Enhancement Course –SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.		1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	<b>23</b>	<b>30</b>		<b>23</b>	<b>30</b>		<b>22</b>	<b>30</b>		<b>25</b>	<b>30</b>		<b>26</b>	<b>30</b>		<b>21</b>	<b>30</b>
<b>Total – 140 Credits</b>																	

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework(LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours**

**First Year – Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses [in Total]	13	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
		<b>23</b>	<b>30</b>

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		<b>23</b>	<b>30</b>

### Second Year – Semester-III

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	14
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		<b>22</b>	<b>30</b>

### Semester-IV

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
Part-1	Language – Tamil	3	6
Part-2	English	3	6
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	13
Part-4	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		<b>25</b>	<b>30</b>

**Third Year  
Semester-V**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
<b>Part-3</b>	Core Courses including Project / Elective Based	22	28
<b>Part-4</b>	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	-
		<b>26</b>	<b>30</b>

**Semester-VI**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>No. of Hours</b>
<b>Part-3</b>	Core Courses including Project / Elective Based & LAB	18	28
<b>Part-4</b>	Professional Competency Skill	2	2
<b>Part-5</b>	Extension Activity	1	-
		<b>21</b>	<b>30</b>

**Consolidated Semester wise and Component wise Credit distribution**

<b>Parts</b>	<b>Sem I</b>	<b>Sem II</b>	<b>Sem III</b>	<b>Sem IV</b>	<b>Sem V</b>	<b>Sem VI</b>	<b>Total Credits</b>
<b>Part I</b>	3	3	3	3	-	-	12
<b>Part II</b>	3	3	3	3	-	-	12
<b>Part III</b>	13	13	13	13	22	18	92
<b>Part IV</b>	4	4	3	6	4	2	23
<b>Part V</b>	-	-	-	-	-	1	1
<b>Total</b>	23	23	22	25	26	21	<b>140</b>

**\*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

**First Year  
Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
Part-I	<b>Language – Tamil-I</b>	3	6
Part-II	<b>English-I</b>	3	6
Part-III	<b>Core Course – CC-1 - Python Programming</b>	5	5
	<b>Core Course – CC-II - Practical : Python Programming Lab</b>	5	5
	<b>Elective 1 - Generic (Any One) –</b> Mathematics I Statistics I Physics I	3	4
Part-IV	<b>Skill Enhancement Course(SEC-1): Office Automation *</b>	2	2
	Basic Tamil *		
	Advanced Tamil I*	2	2
	<b>Skill Enhancement (Foundation Course FC) :</b> Problem Solving Techniques		
		<b>23</b>	<b>30</b>

\*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**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week(L/T/P)</b>
Part-I	<b>Language –Tamil-II</b>	3	6
Part-II	<b>English-II</b>	3	6
Part-III	<b>Core Course - CC III – Data Structures and Algorithm</b>	5	5
	<b>Core Course - CC- IV - Practical: Data Structures and Algorithm Lab</b>	5	5
	<b>Elective Course II - Generic (Any One) –</b> Mathematics II Statistics II Physics II	3	4
Part-IV	<b>Skill Enhancement Course (SEC-2):</b> Fundamentals of Information Technology	2	2
	<b>Skill Enhancement Course (SEC-3):</b> HTML Lab	2	2
	Basic Tamil II*		
	Advanced Tamil II*		
		<b>23</b>	<b>30</b>

**Second Year  
Semester-III**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week(L/T/P)</b>
Part-I	<b>Language – Tamil – III</b>	3	6
Part-II	<b>English – III</b>	3	6
Part-III	<b>Core Course – CC V - Microprocessor and Microcontroller</b>	5	5
	<b>Core Course – CC VI - Practical: Microprocessor and Microcontroller Lab</b>	5	5
	<b>Elective Course III: Generic - (Any One)</b> Mathematics I Statistics I Physics I	3	4
Part-IV	<b>Skill Enhancement Course (SEC-4): PHP Programming Lab</b>	1	1
	<b>Skill Enhancement Course (SEC-5) : Web Design Lab</b>	2	2
	<b>Environmental Studies</b>	-	1
		<b>22</b>	<b>30</b>

**Semester-IV**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
Part-I	<b>Language – Tamil – IV</b>	3	6
Part-II	<b>English – IV</b>	3	6
Part-III	<b>Core Course – CC VII – Java Programming</b>	5	5
	<b>Core Course – CC VIII - Practical: Java Programming Lab</b>	5	5
	<b>Elective Course IV : Generic - (Any One)</b> Mathematics II Statistics II Physics II	3	3
Part-IV	<b>Skill Enhancement Course (SEC-6): Understanding Internet</b>	2	2
	<b>Skill Enhancement Course (SEC-7): Quantitative Aptitude</b>	2	2
	<b>Environmental Studies</b>	2	1
		<b>25</b>	<b>30</b>

**Third Year  
Semester-V**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
Part-III	<b>Core Course – CC IX – Software Engineering</b>	4	5
	<b>Core Course – CC X – Data Analytics using R</b>	4	5
	<b>Core Course – CC XI - Practical - Data Analytics using R Lab</b>	4	5
	<b>Core Course – CC XII - Project with Viva Voce</b>	4	5
	<b>Elective Course V - Discipline Specific – (Any One)</b> Cloud Computing/ Cryptography/ Big Data Analytics	3	4
	<b>Elective Course VI - Discipline Specific –(Any One)</b> Introduction to Data Science / Natural Language Processing/ Image Processing	3	4
Part-IV	<b>Value Education</b>	2	2
	<b>Summer Internship / Industrial Training</b> (Summer vacation at the end of IV semester activity)	2	--
		<b>26</b>	<b>30</b>

**Semester-VI**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
Part-III	<b>Core Course – CC XIII – Computer Network</b>	4	6
	<b>Core Course – CC XIV -.NET Programming</b>	4	6
	<b>Core Course – CC XV – Practical .NET Programming Lab</b>	4	6
	<b>Elective Course VII - Discipline Specific – (Any One)</b> RDBMS with PL/SQL/ IOT and its Applications/ Robotics and its Applications	3	5
	<b>Elective Course VIII - Discipline Specific – (Any One)</b> Software Project Management / Artificial Neural Network / Artificial Intelligence	3	5
Part-IV	<b>Professional Competency Skill Enhancement Course</b> Advanced Excel	2	2
Part –V	<b>Extension Activity</b>	1	--
		<b>21</b>	<b>30</b>

**Total Credits: 140**



# FIRST SEMESTER

## CORE PAPER

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
CC1	Python programming	Core	5	-	-	-	5	25	75	100
<b>Learning Objectives</b>										
<b>L01</b>	To make students understand the concepts of Python programming.									
<b>L02</b>	To apply the OOPs concept in PYTHON programming.									
<b>L03</b>	To impart knowledge on demand and supply concepts									
<b>L04</b>	To make the students learn best practices in PYTHON programming									
<b>L05</b>	To know the costs and profit maximization									
UNIT	Contents									No. of Hours
I	<b>Basics of Python Programming:</b> History of Python-Features of Python-Literal-Constants-Variables - Identifiers–Keywords-Built-in Data Types-Output Statements – Input Statements-Comments – Indentation- Operators-Expressions-Type conversions. <b>Python Arrays:</b> Defining and Processing Arrays – Array methods.									15
II	<b>Control Statements:</b> Selection/Conditional Branching statements: if, if-else, nested if and if-elif-else statements. Iterative Statements: while loop, for loop, else suite in loop and nested loops. <b>Jump Statements:</b> break, continue and pass state ents.									15
III	<b>Functions:</b> Function Definition – Function Call – Variable Scope and its Lifetime-Return Statement. <b>Function Arguments:</b> Required Arguments, Keyword Arguments, Default Arguments and Variable Length Arguments- Recursion. <b>Python Strings:</b> String operations- Immutable Strings - Built-in String Methods and Functions - String Comparison. <b>Modules:</b> import statement- The Python module – dir() function – Modules and Namespace – Defining our own modules.									15
IV	<b>Lists:</b> Creating a list -Access values in List-Updating values in Lists-Nested lists -Basic list operations-List Methods. <b>Tuples:</b> Creating, Accessing, Updating and Deleting Elements in a tuple – Nested tuples– Difference between lists and tuples. <b>Dictionaries:</b> Creating, Accessing, Updating and Deleting Elements in a Dictionary – Dictionary Functions and Methods - Difference between Lists and Dictionaries.									15
V	<b>Python File Handling:</b> Types of files in Python - Opening and Closing files-Reading and Writing files: write() and writelines() methods-append() method – read() and readlines() methods – with keyword – Splitting words – File methods - File Positions- Renaming and deleting files.									15
<b>TOTAL HOURS</b>									75	

<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Learn the basics of python, Do simple programs on python, Learn how to use an array.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Develop program using selection statement, Work with Looping and jump statements, Do programs on Loops and jump statements.	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Concept of function, function arguments, Implementing the concept strings in various application, Significance of Modules, Work with functions, Strings and modules.	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Work with List, tuples and dictionary, Write program using list, tuples and dictionary.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Usage of File handlings in python, Concept of reading and writing files, Do programs using files.	PO1, PO2, PO3, PO4, PO5, PO6
<b>Textbooks</b>		
1	ReemaThareja, —Python Programming using problem solving approach, First Edition, 2017, Oxford University Press.	
2	Dr. R. NageswaraRao, —Core Python Programming, First Edition, 2017, Dream tech Publishers.	
<b>Reference Books</b>		
1.	VamsiKurama, —Python Programming: A Modern Approach, Pearson Education.	
2.	Mark Lutz, Learning Python, Orielly.	
3.	Adam Stewarts, -Python Programming, Online.	
4.	Fabio Nelli, —Python Data Analytics, APress.	
5.	Kenneth A. Lambert, -Fundamentals of Python – First Programs, CENGAGE Publication.	
<b>Web Resources</b>		
1.	<a href="https://www.programiz.com/python-programming">https://www.programiz.com/python-programming</a>	
2.	<a href="https://www.guru99.com/python-tutorials.html">https://www.guru99.com/python-tutorials.html</a>	
3.	<a href="https://www.w3schools.com/python/python_intro.asp">https://www.w3schools.com/python/python_intro.asp</a>	
4.	<a href="https://www.geeksforgeeks.org/python-programming-language/">https://www.geeksforgeeks.org/python-programming-language/</a>	
5.	<a href="https://en.wikipedia.org/wiki/Python_(programming_language)">https://en.wikipedia.org/wiki/Python_(programming_language)</a>	

**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	2	3
CO 3	3	3	3	3	2	2
CO 4	3	3	3	3	2	3
CO 5	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	15	14	15	15	13	14

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
CC2	<b>Python Programming Lab</b>	<b>Core</b>	-	-	5	-	5	40	60	<b>100</b>
<b>Learning Objectives</b>										
LO1	Be able to design and program Python applications.									
LO2	Be able to create loops and decision statements in Python.									
LO3	Be able to work with functions and pass arguments in Python.									
LO4	Be able to build and package Python modules for reusability.									
LO5	Be able to read and write files in Python.									

<b>LAB EXERCISES</b>	<b>Required Hours</b>
1. Program using variables, constants, I/O statements in Python. 2. Program using Operators in Python. 3. Program using Conditional Statements. 4. Program using Loops. 5. Program using Jump Statements. 6. Program using Functions. 7. Program using Recursion. 8. Program using Arrays. 9. Program using Strings. 10. Program using Modules. 11. Program using Lists. 12. Program using Tuples. 13. Program using Dictionaries. 14. Program for File Handling.	<b>75</b>

**Course Outcomes**

On completion of this course, students will

CO1	Demonstrate the understanding of syntax and semantics of PYTHON language
CO2	Identify the problem and solve using PYTHON programming techniques.
CO3	Identify suitable programming constructs for problem solving.
CO4	Analyze various concepts of PYTHON language to solve the problem in an efficient way.
CO5	Develop a PYTHON program for a given problem and test for its correctness.

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
<b>CO 1</b>	3	3	3	3	3	3
<b>CO 2</b>	3	3	1	3	2	3
<b>CO 3</b>	3	3	3	3	2	2
<b>CO 4</b>	3	3	3	3	2	3
<b>CO 5</b>	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	15	15	13	15	13	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
	<b>OFFICE AUTOMATION</b>	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
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	<b>Word Processing:</b> 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	<b>Spreadsheets:</b> Excel– opening,enteringtextanddata,formatting,navigating;Formulas– entering,handlingand copying; Charts–creating, formatting and printing,analysistables,preparationoffinancialstatements,introducti ontodataanalytics.									6	
IV	<b>Database Concepts:</b> 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	<b>Power point:</b> 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	
	<b>Total</b>									<b>30</b>	

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,PO8
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,PO8
<b>Text Book</b>		
1	PeterNorton,—IntroductiontoComputers—TataMcGraw-Hill.	
<b>Reference Books</b>		
1.	Jennifer Ackerman Kettel, Guy Hat-Davis, Curt Simmons, —Microsoft 2003, Tata McGrawHill.	
<b>Web Resources</b>		
1.	<a href="https://www.udemy.com/course/office-automation-certificate-course/">https://www.udemy.com/course/office-automation-certificate-course/</a>	
2.	<a href="https://www.javatpoint.com/automation-tools">https://www.javatpoint.com/automation-tools</a>	

### 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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>15</b>

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
	<b>Problem Solving Techniques</b>	FC	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
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	<b>Introduction:</b> 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. <b>Programming Languages:</b> Machine language, Assembly language, High-level language, 4 GL and 5GL-Features of good programming language. Translators: Interpreters and Compilers.									<b>6</b>	
II	<b>Data:</b> Data types, Input, Processing of data, Arithmetic Operators, Hierarchy of operations and Output. Different phases in Program Development Cycle (PDC). <b>Structured Programming: Algorithm:</b> Features of good algorithm, Benefits and drawbacks of algorithm. <b>Flowcharts:</b> Advantages and limitations of flowcharts, when to use flowcharts, flowchart symbols and types of flowcharts. <b>Pseudocode:</b> Writing a pseudocode. Coding, documenting and testing a program: Comment lines and types of errors. <b>Program design:</b> Modular Programming.									<b>6</b>	
III	<b>Selection Structures:</b> Relational and Logical Operators - Selecting from Several Alternatives – Applications of Selection Structures. <b>Repetition Structures:</b> Counter Controlled Loops –Nested Loops– Applications of Repetition Structures.									<b>6</b>	
IV	<b>Data:</b> Numeric Data and Character Based Data. <b>Arrays:</b> One Dimensional Array - Two Dimensional Arrays – Strings as Arrays of Characters.									<b>6</b>	

V	<b>Data Flow Diagrams:</b> Definition, DFD symbols and types of DFDs. <b>Program Modules:</b> Subprograms-Value and Reference parameters- Scope of a variable - Functions – Recursion. <b>Files:</b> File Basics-Creating and reading a sequential file- Modifying Sequential Files.	<b>6</b>
<b>TOTAL HOURS</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Textbooks</b>		
1	<b>Stewart Venit</b> , -Introduction to Programming: Concepts and Design, Fourth Edition, 2010, Dream Tech Publishers.	
<b>Web Resources</b>		
1.	<a href="https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm">https://www.codesansar.com/computer-basics/problem-solving-using-computer.htm</a>	
2.	<a href="http://www.nptel.iitm.ac.in/video.php?subjectId=106102067">http://www.nptel.iitm.ac.in/video.php?subjectId=106102067</a>	
3.	<a href="http://utubersity.com/?page_id=876">http://utubersity.com/?page_id=876</a>	

#### 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
<b>Weightage of course contributed to each PSO</b>	15	14	14	15	15	14

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



## Semester II

Title of the Course / Paper	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	M a r k s		
									CIA	External	Total
<b>CC3</b>	<b>DATA STRUCTURE AND ALGORITHMS</b>	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
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
	<b>Total</b>										<b>75</b>
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,						PO2				

	linked lists, stacks and queues	
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
<b>Text Book</b>		
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	
<b>Reference Books</b>		
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	
<b>Web Resources</b>		
1.	<a href="https://www.programiz.com/dsa">https://www.programiz.com/dsa</a>	
2.	<a href="https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/">https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/</a>	

### 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
<b>Weightage of course contributed to each PSO</b>	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	M a r k s		
									CIA	External	Total
	<b>DATA STRUCTURE AND ALGORITHMS LAB</b> [Note: Practicals may be offered through C / C++ / Python]	Core	-	-	5	-	5	5	40	60	100
<b>Learning Objectives</b>											
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										
Sl. No	Contents										No. of Hours
1.	Write a program to implement the List ADT using arrays and linked lists.										<b>75</b>
2.	Write a programs to implement the following using a singly linked list. <ul style="list-style-type: none"> <li>• Stack ADT</li> <li>• Queue ADT</li> </ul>										
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: <ul style="list-style-type: none"> <li>• Insert an element into a binary search tree.</li> <li>• Delete an element from a binary search tree.</li> <li>• Search for a key element in a binary search tree.</li> </ul>										
6.	Write a program to perform the following operations <ul style="list-style-type: none"> <li>• Insertion into an AVL-tree</li> <li>• Deletion from an AVL-tree</li> </ul>										

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: <ul style="list-style-type: none"> <li>• Linear search</li> <li>• Binary search.</li> </ul>	
9.	Write a programs for implementing the following sorting methods: <ul style="list-style-type: none"> <li>• Bubble sort</li> <li>• Selection sort</li> <li>• Insertion sort</li> <li>• Radix sort.</li> </ul>	
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programmeme Outcome</b>
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
<b>Text Book</b>		
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	
<b>Reference Books</b>		
1	Thomas H.Cormen,ChalesE.Leiserson,RonaldL.Rivest, Clifford Stein, —Introduction to Algorithms  , McGraw Hill 2009, 3rd Edition	
2.	Aho, Hopcroft and Ullman, —Data Structures and Algorithms  , Pearson Education 2003	
<b>Web Resources</b>		
1.	<a href="https://www.programiz.com/dsa">https://www.programiz.com/dsa</a>	
2.	<a href="https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/">https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/</a>	

### 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
<b>Weightage of course contributed to each PSO</b>	15	15	13	15	13	15

**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
	<b>Fundamentals of Information Technology</b>	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
<b>LO1</b>	Understand basic concepts and terminology of information technology.										
<b>LO2</b>	Have a basic understanding of personal computers and their operation										
<b>LO3</b>	Be able to identify data storage and its usage										
<b>LO4</b>	Get great knowledge of software and its functionalities										
<b>LO5</b>	Understand about operating system and their uses										
<b>UNIT</b>	<b>Contents</b>									<b>No. Of. Hours</b>	
I	<b>Introduction to Computers:</b> 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									<b>6</b>	
II	<b>Basic Computer Organization:</b> 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.									<b>6</b>	

III	<b>Storage Fundamentals:</b> 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	<b>Software:</b> 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	<b>Operating System:</b> Functions, Measuring System Performance, Assemblers, Compilers and Interpreters. Batch Processing, Multiprogramming, Multi Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.	6
<b>TOTAL HOURS</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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 or output unit.	PO1, PO2, 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
<b>Textbooks</b>		
1	Anoop Mathew, S. Kavitha Murugesan (2009), —Fundamental of Information Technology, Majestic Books.	
2	Alexis Leon, Mathews Leon, Fundamental of Information Technology, 2 <sup>nd</sup> Edition.	
3	S. K Bansal, —Fundamental of Information Technology.	
<b>Reference Books</b>		
1.	Bhardwaj Sushil Puneet Kumar, —Fundamental of Information Technology	
2.	GG WILKINSON, —Fundamentals of Information Technology, Wiley-Blackwell	
3.	A Ravichandran, —Fundamentals of Information Technology, Khanna Book Publishing	
<b>Web Resources</b>		

1.	<a href="https://testbook.com/learn/computer-fundamentals">https://testbook.com/learn/computer-fundamentals</a>
2.	<a href="https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html">https://www.tutorialsmate.com/2020/04/computer-fundamentals-tutorial.html</a>
3.	<a href="https://www.javatpoint.com/computer-fundamentals-tutorial">https://www.javatpoint.com/computer-fundamentals-tutorial</a>
4.	<a href="https://www.tutorialspoint.com/computer_fundamentals/index.htm">https://www.tutorialspoint.com/computer_fundamentals/index.htm</a>
5.	<a href="https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf">https://www.nios.ac.in/media/documents/sec229new/Lesson1.pdf</a>

**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
<b>Weightage of course contributed to each PSO</b>	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	Exter	Total
	<b>HTML LAB</b>	Skill Enha. Course (SEC)	-	-	2		2	40	60	100
<b>Learning Objectives</b>										
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								<b>30</b>	

	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	
<b>TOTAL HOURS</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Textbooks</b>		
1	—Mastering HTML5 and CSS3 Made Easy!, TeachUComp Inc., 2014.	
2	<b>Thomas Michaud, “Foundations of Web Design: Introduction to HTML &amp; CSS”</b>	
<b>Web Resources</b>		
1.	<a href="https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf">https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf</a>	
2.	<a href="https://www.w3schools.com/html/default.asp">https://www.w3schools.com/html/default.asp</a>	

**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
<b>Weightage of course contributed to each PSO</b>	14	15	14	14	15	15

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



## SECOND YEAR

### SEMESTER III

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
CC5	<b>Microprocessor and Microcontroller</b>	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
LO1	To introduce the internal organization of Intel 8085 Microprocessor.										
LO2	To know about various instruction sets and classifications										
LO3	To enable the students to write assembly language programs using 8085.										
LO4	To interface the peripheral devices to 8085 using Interrupt 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.										15
II	8085 Microprocessor – Pinout and Signals – Functional block diagram - 8085 Instruction Set and Classifications.										15
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.										15
IV	The 8085 Interrupts – RIM AND SIM instructions-8259 Programmable Interrupt Controller-Direct Memory Access (DMA) and 8257 DMA controller.										15
V	Introduction to Microcontroller - Microcontroller Vs Microprocessor - 8051 Microcontroller architecture - 8051 pin description. Timers and Counters – Operating Modes- Control										15

	Registers. Interrupts – Interrupts in 8051 - Interrupts Control Register – Execution of interrupt.	
	<b>Total</b>	<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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
<b>Text Book</b>		
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, 8051l, Tata McGraw Hill Education Private Limited. [For unit V].	
<b>Reference Books</b>		
1.	Mathur- ---Introduction to Microprocessorl- 3rd Edition- Tata McGraw-Hill -1993.	
2.	Raj Kamal - ---Microcontrollers: Architecture, Programming, Interfacing and System Designl, Pearson Education, 2005.	
3.	Krishna Kant, -Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096l, PHI, 2008	
<b>Web Resources</b>		
1.	E-content from open source libraries	
2.	<a href="https://www.bing.com/">https://www.bing.com/</a> , <a href="https://theopennotes.in/">https://theopennotes.in/</a>	

**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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>15</b>	<b>14</b>	<b>12</b>	<b>14</b>	<b>10</b>

**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
	<b>Microprocessor and microcontroller Lab</b>	Core	-	-	5	-	5		40	60	100
<b>Learning Objectives</b>											
LO1	To introduce the internal organization of Intel 8085 Microprocessor.										
LO2	To know about various instruction sets and classifications										
LO3	To enable the students to write assembly language programs using 8085.										
LO4	To interface the peripheral devices to 8085 using Interrupt controller and DMA interface.										
LO5	To provide real-life applications using microcontroller.										
	<b>Details</b>									<b>No. of Hours</b>	
	<b>List of Exercises:</b>										
	Addition and Subtraction 1. 8 - bit addition										

	<ul style="list-style-type: none"> <li>2. 16 - bit addition</li> <li>3. 8 - bit subtraction</li> <li>4. BCD subtraction</li> </ul> <p>II. Multiplication and Division</p> <ul style="list-style-type: none"> <li>1. 8 - bit multiplication</li> <li>2. BCD multiplication</li> <li>3. 8 - bit division</li> </ul> <p>III. Sorting and Searching</p> <ul style="list-style-type: none"> <li>1. Searching for an element in an array.</li> <li>2. Sorting in Ascending and Descending order.</li> <li>3. Finding the largest and smallest elements in an array.</li> <li>4. Reversing array elements.</li> <li>5. Block move.</li> </ul> <p>IV. Code Conversion</p> <ul style="list-style-type: none"> <li>1. BCD to Hex and Hex to BCD</li> <li>2. Binary to ASCII and ASCII to binary</li> <li>3. ASCII to BCD and BCD to ASCII</li> </ul> <p>V. Simple programs on 8051 Microcontroller</p> <ul style="list-style-type: none"> <li>1. Addition</li> <li>2. Subtraction</li> <li>3. Multiplication</li> <li>4. Division</li> <li>5. Interfacing Experiments using 8051 <ul style="list-style-type: none"> <li>1. Realisation of Boolean Expression through ports.</li> <li>2. Time delay generation using subroutines.</li> <li>3. Display LEDs through ports</li> </ul> </li> </ul>	75
	<b>Total</b>	<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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	PO1,PO2

	different logic	
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,PO5
<b>Text Book</b>		
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].	
<b>Reference Books</b>		
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	
<b>Web Resources</b>		
1.	E-content from open source libraries	
2.	<a href="https://www.bing.com/">https://www.bing.com/</a>	

**Mapping with Programme Outcomes:**

CO/ PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

**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
	<b>PHP PROGRAMMING LAB</b>	Skill Enha.Course (SEC)	1	-	-	-	1	1	40	60	100
<b>Learn ing Objectives</b>											
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
	<ol style="list-style-type: none"> <li>1. Write a PHP program which adds up columns and rows of giventable</li> <li>2. Write a PHP program to compute the sum of first n given prime numbers</li> <li>3. Write a PHP program to validate an email address</li> <li>4. Write a PHP program to convert a number written in words todigit.</li> <li>5. Write a PHP script to delay the program execution for the given number of seconds.</li> <li>6. Write a PHP script, which changes the colour of the first character of a word</li> <li>7. Write a PHP program to generate a multiplication table of a number.</li> <li>8. Write a PHP program to calculate the Factorial of a number.</li> <li>9. Write a PHP script to read a file, reverse its contents, and writethe result back to a new file</li> <li>10. Write a PHP script to look through the current directory and rename all the files with extension .txt to extension .xtx</li> </ol>										15
	<b>Total</b>										<b>15</b>
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.			
<b>Text Book</b>											
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), <i>-HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)</i> , Paperback 2016, 2 <sup>nd</sup> Edition.
Web Resources	
1.	Opensource digital libraries: PHP Programming
2.	<a href="https://www.w3schools.com/php/default.asp">https://www.w3schools.com/php/default.asp</a>

#### 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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.	Marks		
									CIA	External	Total
	<b>WEB DESIGNING LAB</b>	Skill Enha. Course (SEC)	-	-	2	-	2		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.								30		

	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)	
	<b>Total</b>	<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO1	Develop working knowledge of HTML	PO1, PO3, PO6, PO8
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.	PO2, PO6, PO7
<b>Text Book</b>		
1	Pankaj Sharma, —Web Technology, SkKataria & Sons Bangalore 2011.	
2	Mike Mcgrath, —Java Script, Dream Tech Press 2006, 1st Edition.	
3	Achyut S Godbole & Atul Kahate, —Web Technologies, 2002, 2nd Edition.	
<b>Reference Books</b>		
1.	Laura Lemay, Rafe Colburn, 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.	
<b>Web Resources</b>		
1.	NPTEL & MOOC courses titled Web Design and Development.	
2.	<a href="https://www.geeksforgeeks.org">https://www.geeksforgeeks.org</a>	



**Mapping with Programme Outcomes:**

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

**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
	<b>Java Programming</b>	Core	5	-	-	-	5	5	25	75	100
<b>Learning Objectives</b>											
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	<b>Introduction:</b> Review of Object Oriented concepts - History of Java - Java buzzwords - JVM architecture - Datatypes - Variables - Scope and life time of variables - arrays - operators - control statements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - Static Method String and StringBuffer Classes.								15		
II	<b>Inheritance:</b> 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. <b>Packages:</b> Definition - Access Protection - Importing Packages. <b>Interfaces:</b> Definition - Implementation - Extending Interfaces. <b>Exception Handling:</b> try - catch - throw - throws - finally - Built-in exceptions - Creating own Exception classes.								15		

III	<p><b>Multithreaded Programming:</b> Thread Class - Runnable interface –Synchronization–Using synchronizedmethods– Using synchronized statement- InterthreadCommunication – Deadlock.</p> <p><b>I/O Streams:</b> Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.</p>	15
IV	<p><b>AWT Controls:</b> 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.</p> <p><b>Event Handling:</b> Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes</p>	15
V	<p><b>Swing:</b> 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.</p>	15
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	Understand the basic Object-oriented concepts.Implement the basic constructs of Core Java.	PO1, PO2, PO6
<b>CO2</b>	Implement inheritance, packages, interfaces and exception handling of Core Java.	PO2, PO3, PO8
<b>CO3</b>	Implement multi-threading and I/O Streams of Core Java	PO1, PO3, PO5
<b>CO4</b>	Implement AWT and Event handling.	PO2, PO6
<b>CO5</b>	Use Swing to create GUI.	PO1, PO3, PO6
<b>Text Books:</b>		
1.	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010	
2.	Gary Cornell, <i>Core Java 2 Volume I – Fundamentals</i> , Addison Wesley, 1999	

<b>References :</b>	
1.	Head First Java, O’Rielly Publications,
2.	Y. Daniel Liang, <i>Introduction to Java Programming</i> , 7th Edition, Pearson Education India, 2010
<b>Web Resources</b>	
1.	<a href="https://javabeginnerstutorial.com/core-java-tutorial">https://javabeginnerstutorial.com/core-java-tutorial</a>
2.	<a href="http://docs.oracle.com/javase/tutorial/">http://docs.oracle.com/javase/tutorial/</a>
3.	<a href="https://www.coursera.org/">https://www.coursera.org/</a>

### 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
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>11</b>

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
	<b>Java Programming Lab</b>	Core	-	-	5	-	5	5	40	60	100
<b>Learning Objectives</b>											
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.										
<b>EXCERCISE</b>	<b>Details</b>										
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: <ul style="list-style-type: none"> <li>a. Length of a string</li> <li>b. Reverse a string</li> <li>c. Delete a substring from the given string</li> </ul>	
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.	75
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. <ul style="list-style-type: none"> <li>a. Arithmetic Exception</li> <li>b. Number Format Exception</li> <li>c. ArrayIndexOutOfBoundsException</li> <li>d. NegativeArraySizeException</li> </ul>	
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.	
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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
<b>Text Book</b>		
1	Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.	
2.	Gary Cornell, <i>Core Java 2 Volume I – Fundamentals</i> , Addison Wesley, 1999.	
<b>Reference Books</b>		
1.	Head First Java, O’Rielly Publications,	
2.	Y. Daniel Liang, <i>Introduction to Java Programming</i> , 7th Edition, Pearson Education India, 2010.	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/java/">https://www.w3schools.com/java/</a>	
2.	<a href="http://java.sun.com">http://java.sun.com</a>	
3.	<a href="http://www.afu.com/javafaq.html">http://www.afu.com/javafaq.html</a>	

**Mapping with Programme Outcomes:**

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

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



Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	<b>UNDERSTANDING INTERNET</b>	Skill Enha. Course (SEC)	2	-	-		2	25	75	100
<b>Learning Objectives</b>										
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									
<b>UNIT</b>	<b>Contents</b>								<b>No. Of. Hours</b>	
I	The emergence of internet as a mass medium–the world of ‘_world wide web’.								<b>6</b>	
II	Features of internet as a technology.								<b>6</b>	
III	Internet as a source of infotainment – classification based on content and style.								<b>6</b>	
IV	Demographic and psychographic descriptions of internet ‘_audiences’ – effect of internet on the values and life-styles.								<b>6</b>	
V	Present issues such as cyber crime and future possibilities.								<b>6</b>	
<b>TOTAL HOURS</b>								<b>30</b>		
<b>Course Outcomes</b>								<b>Programme Outcomes</b>		
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		
<b>Textbooks</b>										
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.									
<b>Reference Book</b>										
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.
<b>Web Resources</b>	
1	<a href="https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf">https://www.teachucomp.com/samples/html/5/manuals/Mastering-HTML5-CSS3.pdf</a>
2	<a href="https://www.w3schools.com/html/default.asp">https://www.w3schools.com/html/default.asp</a>

**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
<b>Weightage of course contributed to each PSO</b>	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	
	<b>Quantitative Aptitude</b>	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100	
<b>Learning Objectives</b>												
LO1	To understand the basic concepts of numbers											
LO2	Understand and apply the concept of percentage, profit & loss											
LO3	To study the basic concepts of time and work, interests											
LO4	To learn the concepts of permutation, probability, discounts											
LO5	To study about the concepts of data representation, graphs											
UNIT	Contents							No. of Hours				
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers.							6				

II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.	6
III	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.	6
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.	6
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts-Line graphs.	6
<b>Total</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO1	understand the concepts, application and the problems of numbers	PO1
CO2	To have basic knowledge and understanding about percentage, profit & loss related processings	PO1, PO2
CO3	To understand the concepts of time and work	PO4, PO6
CO4	Speaks about the concepts of probability, discount	PO4, PO5
CO5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO6
<b>Text Book</b>		
1	—Quantitative Aptitude, R.S. AGGARWAL., S.Chand & Company Ltd.,	
<b>Web Resources</b>		
1.	<a href="https://www.javatpoint.com/aptitude/quantitative">https://www.javatpoint.com/aptitude/quantitative</a>	
2.	<a href="https://www.toppr.com/guides/quantitative-aptitude/">https://www.toppr.com/guides/quantitative-aptitude/</a>	

**Mapping with Programme Outcomes:**

<b>MAPPING TABLE</b>						
<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>
<b>CO4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1</b>
<b>CO5</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>8</b>	<b>12</b>	<b>5</b>	<b>8</b>	<b>13</b>	<b>9</b>

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

**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
<b>Learning Objectives</b>											
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.										
UNIT	Contents								No. of Hours		
I	<p><b>Introduction:</b> 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.</p> <p><b>Software Life Cycle Models:</b> Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.</p>								15		
II	<p><b>Requirements Analysis and Specification:</b> Requirements gathering and analysis, Software requirements specification (SRS)</p> <p><b>Software Design:</b> Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design</p>								15		
III	<p><b>Function-Oriented Software Design:</b> Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's),</p>								15		

	structured design, detailed design. <b>User-Interface design:</b> Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.	
IV	<b>Coding and Testing:</b> 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. <b>Software Reliability and Quality Management:</b> Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.	15
V	<b>Computer Aided Software Engineering:</b> 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. <b>Software Maintenance:</b> Characteristic of software maintenance; software reverseengineering; software maintenance process models; estimation of maintenance cost.	15
	<b>Total</b>	<b>75</b>
<b>Course Outcomes</b>		
<b>Course Outcomes</b>	On completion of this course, students will;	
<b>CO1</b>	Gain basic knowledge of analysis and design of systems	PO1
<b>CO2</b>	Ability to apply software engineering principles and techniques	PO1, PO2
<b>CO3</b>	Model a reliable and cost-effective software system	PO4, PO6
<b>CO4</b>	Ability to design an effective model of the system	PO4, PO5, PO6
<b>CO5</b>	Perform Testing at various levels and produce an efficient system.	PO3, PO6

<b>Text Books</b>	
1.	Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018
<b>References Books</b>	
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
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>Weightage of course contribute d to each PO/PSO</b>	<b>15</b>	<b>13</b>	<b>14</b>	<b>10</b>	<b>10</b>	<b>11</b>

**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
	<b>Data analytics using R</b>	Core	5	-	-	-	4	5	25	75	100
<b>Course Objective</b>											
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
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Text Book</b>		
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	
<b>Reference Books</b>		
1.	Garrett Grolemond, Hadley Wickham,   Hands-On Programming with R: Write Your Own Functions and Simulations   , 1st Edition, 2014	
2.	Venables , W.N., and Ripley,   S programming —, Springer, 2000.	
<b>Web Resources</b>		
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>	

**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
<b>Weightageofcourse contributed to each PSO</b>	<b>14</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>13</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	M a r k s		
									CIA	External	Total
	<b>Data analytics using R Lab</b>	Core	-	-	5	-	4	5	40	60	100
<b>Course Objective</b>											
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.										
<b>Sl. No</b>	<b>Contents</b>										
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.	<b>75</b>
5.	Write a program to join columns and rows in a data frame using cbind() and rbind() in R.	
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.	
<b>Total</b>		
<b>Course Outcomes</b>		<b>Program Outcome</b>
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
<b>Text Book</b>		
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	
<b>Reference Books</b>		
1	Garrett Grolemond, Hadley Wickham,  Hands-On Programming with R: Write Your Own Functions and Simulations   , 1st Edition, 2014	

2.	Venables ,W.N.,andRipley,IS programming—, Springer, 2000.
<b>Web Resources</b>	
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
	<b>Cloud Computing</b>	Elective	4	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
LO1	Learning fundamental concepts and Technologies of Cloud Computing.										
LO2	Learning various cloud service types and their uses and pitfalls.										
LO3	To learn about Cloud Architecture and Application design.										
LO4	To know the various aspects of application design, benchmarking and security on the Cloud.										
LO5	To learn the various Case Studies in Cloud Computing.										
UNIT	Contents										No. of Hours
I	Introduction to Cloud Computing: Definition of Cloud Computing – Characteristics of Cloud Computing – Cloud Models – Cloud Service Examples – Cloud-based Services and Applications.  Cloud Concepts and Technologies: Virtualization – Load balancing – Scalability and Elasticity – Deployment – Replication – Monitoring – Software Defined Networking – Network Function Virtualization – MapReduce – Identity and Access Management – Service Level Agreements – Billing.										12
II	Cloud Services  Compute Services: Amazon Elastic Computer Cloud - Google Compute Engine - Windows Azure Virtual Machines  Storage Services: Amazon Simple Storage Service - Google Cloud Storage - Windows Azure Storage										12

	<p>Database Services: Amazon Relational Data Store - Amazon Dynamo DB - Google Cloud SQL - Google Cloud Data Store - Windows Azure SQL Database - Windows Azure Table Service</p> <p>Application Services: Application Runtimes and Frameworks - Queuing Services - Email Services - Notification Services - Media Services</p> <p>Content Delivery Services: Amazon CloudFront - Windows Azure Content Delivery Network</p> <p>Analytics Services: Amazon Elastic MapReduce - Google MapReduce Service - Google BigQuery - Windows Azure HDInsight</p> <p>Deployment and Management Services: Amazon Elastic Beanstack - Amazon CloudFormation</p> <p>Identity and Access Management Services: Amazon Identity and Access Management - Windows Azure Active Directory</p> <p>Open Source Private Cloud Software: CloudStack – Eucalyptus – OpenStack</p>	
III	<p><b>Cloud Application Design:</b> Introduction – Design Consideration for Cloud Applications – Scalability – Reliability and Availability – Security – Maintenance and Upgradation – Performance – Reference Architectures for Cloud Applications – Cloud Application Design Methodologies: Service Oriented Architecture (SOA), Cloud Component Model, IaaS, PaaS and SaaS Services for Cloud Applications, Model View Controller (MVC), RESTful Web Services – Data Storage Approaches: RelationalApproach (SQL), Non-RelationalApproach (NoSQL).</p>	12
IV	<p><b>Cloud Application Benchmarking and Tuning:</b> Introduction to Benchmarking – Steps in Benchmarking – WorkloadCharacteristics – Application Performance Metrics – Design Consideration for BenchmarkingMethodology – Benchmarking Tools and Types of Tests – DeploymentPrototyping.</p> <p><b>Cloud Security:</b> Introduction – CSA Cloud Security Architecture – Authentication (SSO) – Authorization – Identity and Access Management – Data Security : Securing data atrest, securing data in motion – Key Management – Auditing.</p>	12

V	<b>Case Studies:</b> Cloud Computing for Healthcare – Cloud Computing for EnergySystems - Cloud Computing for Transportation Systems - Cloud Computing for ManufacturingIndustry - Cloud Computing for Education.	12
<b>Total</b>		<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO 1	Understand the fundamental concepts and Technologies in Cloud Computing.	PO1
CO 2	Able to understand various cloud service types and their uses and pitfalls.	PO1, PO2
CO 3	Able to understand Cloud Architecture and Application design.	PO4, PO5
CO 4	Understand the various aspects of application design, benchmarking and security in the Cloud.	PO4, PO5, PO6
CO 5	Understand various Case Studies in Cloud Computing.	PO3, PO6
<b>Text Book</b>		
1	ArshdeepBahga, Vijay Madiseti, <i>Cloud Computing – A Hands On Approach</i> , Universities Press (India) Pvt. Ltd., 2018	
<b>Reference Books</b>		
1.	Anthony T Velte, Toby J Velte, Robert Elsenpeter, <i>Cloud Computing: A Practical Approach</i> , Tata McGraw-Hill, 2013.	
2.	Barrie Sosinsky, <i>Cloud Computing Bible</i> , Wiley India Pvt. Ltd., 2013.	
3.	David Crookes, <i>Cloud Computing in Easy Steps</i> , Tata McGraw Hill, 2015.	
4.	Dr. Kumar Saurabh, <i>Cloud Computing</i> , Wiley India, Second Edition 2012.	
<b>Web Resources</b>		
1.	<a href="https://en.wikipedia.org/wiki/Cloud_computing">https://en.wikipedia.org/wiki/Cloud_computing</a>	
2.	<a href="https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7">https://link.springer.com/chapter/10.1007/978-3-030-34957-8_7</a>	
3.	<a href="https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf">https://webobjects.cdw.com/webobjects/media/pdf/solutions/cloud-computing/121838-CDW-Cloud-Computing-Reference-Guide.pdf</a>	

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	3	2
CO2	3	3	2	3	3	2
CO3	3	3	3	3	3	2
CO4	3	3	2	3	3	2
CO5	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	<b>CRYPTOGRAPHY</b>	Elective	4	-	-	-	3	25	75	100
<b>Learning Objectives</b>										
LO1	To understand the fundamentals of Cryptography									
LO2	To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.									
LO3	To understand the various key distribution and management schemes.									
LO4	To understand how to deploy encryption techniques to secure data in transit across data networks									
LO5	To design security applications in the field of Information technology									
UNIT	Contents									No. Of. Hours
I	<b>Introduction:</b> The OSI security Architecture – Security Attacks – Security Mechanisms – Security Services – A model for network Security.									<b>12</b>
II	<b>Classical Encryption Techniques:</b> Symmetric cipher model – <b>Substitution Techniques:</b> Caesar Cipher – Monoalphabetic cipher – Play fair cipher – Poly Alphabetic Cipher – Transposition techniques – Stenography									<b>12</b>
III	<b>Block Cipher and DES:</b> Block Cipher Principles – DES – The Strength of DES – <b>RSA:</b> The RSA algorithm.									<b>12</b>
IV	<b>Network Security Practices:</b> IP Security overview - IP Security architecture – Authentication Header. <b>Web Security:</b> SecureSocketLayer and Transport Layer Security – Secure Electronic Transaction.									<b>12</b>
V	Intruders – Malicious software – Firewalls.									<b>12</b>
<b>TOTAL HOURS</b>									<b>60</b>	

Course Outcomes		Programme Outcomes
CO	On completion of this course, students will	
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	PO1, PO2, PO3, PO4, PO5, PO6
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms	PO1, PO2, PO3, PO4, PO5, PO6
CO3	Apply the different cryptographic operations of public key cryptography	PO1, PO2, PO3, PO4, PO5, PO6
CO4	Apply the various Authentication schemes to simulate different applications.	PO1, PO2, PO3, PO4, PO5, PO6
CO5	Understand various Security practices and System security standards	PO1, PO2, PO3, PO4, PO5, PO6
<b>Textbooks</b>		
1	<b>William Stallings</b> , —Cryptography and Network Security Principles and Practices.	
<b>Reference Books</b>		
1.	<b>Behrouz A. Foruzan</b> , –Cryptography and Network Security, Tata McGraw-Hill, 2007.	
2	<b>Atul Kahate</b> , “Cryptography and Network Security”, Second Edition, 2003, TMH.	
3	<b>M.V. Arun Kumar</b> , “Network Security”, 2011, First Edition, USP.	
<b>Web Resources</b>		
1	<a href="https://www.tutorialspoint.com/cryptography/">https://www.tutorialspoint.com/cryptography/</a>	
2	<a href="https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography">https://gpgtools.tenderapp.com/kb/how-to/introduction-to-cryptography</a>	

### Mapping with Programme Outcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO 1	3	3	3	2	3	2
CO 2	3	2	3	2	3	3
CO 3	3	3	3	2	3	3
CO 4	2	3	3	3	2	3
CO 5	3	2	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	14	13	15	12	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
	<b>Big Data Analytics</b>	Elective	4	-	-	-	3	4	25	75	100
<b>Course Objective</b>											
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
<b>Total</b>		<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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 NoSQL databases and management.	PO3, PO4
<b>Text Book</b>		
1	Anand Rajaraman and Jeffrey David Ullman, —Mining of Massive Datasets, Cambridge University Press, 2012.	
<b>Reference Books</b>		
1.	David Loshin, —Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, Morgan Kaufmann/Elsevier Publishers, 2013	
2.	EMC Education Services, —Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley publishers, 2015.	
<b>Web Resources</b>		
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>	
2.	<a href="https://www.sas.com/en_us/insights/analytics/big-data-analytics.html">https://www.sas.com/en_us/insights/analytics/big-data-analytics.html</a>	

**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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>13</b>

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
	<b>Introduction to Data Science</b>	Elective	4	-	-	-	3	4	25	75	100
<b>Learning Objectives</b>											
LO1	To learn about basics of Data Science and Big data.										
LO2	To learn about overview and building process of Data Science.										
LO3	To learn about various Algorithms in Data Science.										
LO4	To learn about Hadoop Framework.										
LO5	To learn about case study about Data Science.										
UNIT	Contents										No. of Hours
I	<b>Introduction:</b> Benefits and uses – Facts of data – Data science process – Big data ecosystem and data science										12
II	<b>The Data science process:</b> Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building .										12
III	<b>Algorithms :</b> Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised										12
IV	<b>Introduction to Hadoop :</b> Hadoop framework – Spark – replacing MapReduce– NoSQL – ACID – CAP – BASE – types										12
V	<b>Case Study:</b> Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation										12
<b>Total</b>										<b>60</b>	

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
CO1	Understand the basics in Data Science and Big data.	PO1
CO2	Understand overview and building process in Data Science.	PO1, PO2
CO3	Understand various Algorithms in Data Science.	PO3, PO6
CO4	Understand Hadoop Framework in Data Science.	PO4, PO5
CO5	Case study in Data Science.	PO3, PO5
<b>Text Book</b>		
1	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, —Introducing Data Science, manning publications 2016	
<b>Reference Books</b>		
1.	Roger Peng, —The Art of Data Science, lulu.com 2016.	
2.	MurtazaHaider, —Getting Started with Data Science – Making Sense of Data with Analytics, IBM press, E-book.	
3.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali,—Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Dreamtech Press 2016.	
4.	Annalyn Ng, Kenneth Soo, —Numsense! Data Science for the Layman: No Math Added, 2017, 1st Edition.	
5.	Cathy O'Neil, Rachel Schutt, —Doing Data Science Straight Talk from the Frontline, O'Reilly Media 2013.	
6.	Lillian Pierson, —Data Science for Dummies, 2017 II Edition	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/datascience/">https://www.w3schools.com/datascience/</a>	
2.	<a href="https://en.wikipedia.org/wiki/Data_science">https://en.wikipedia.org/wiki/Data_science</a>	
3.	<a href="http://www.cmap.polytechnique.fr/~lepenec/en/post/references/refs/">http://www.cmap.polytechnique.fr/~lepenec/en/post/references/refs/</a>	

#### Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	3	2
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>11</b>	<b>10</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Marks		
								CIA	External	Total
	<b>NATURAL LANGUAGE PROCESSING</b>	Elective	4	-	-		3	25	75	100
<b>Learning Objectives</b>										
<b>LO1</b>	To understand approaches to syntax and semantics in NLP.									
<b>LO2</b>	To learn natural language processing and to learn how to apply basic algorithms in this field.									
<b>LO3</b>	To understand approaches to discourse, generation, dialogue and summarization within NLP.									
<b>LO4</b>	To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, pragmatics etc.									
<b>LO5</b>	To understand current methods for statistical approaches to machine translation.									
<b>UNIT</b>	<b>Contents</b>								<b>No. Of. Hours</b>	
I	<b>Introduction</b> : Natural Language Processing tasks in syntax, semantics, and pragmatics – Issue- Applications – The role of machine learning – Probability Basics –Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.								<b>12</b>	
II	<b>Word level and Syntactic Analysis:</b> 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.								<b>12</b>	
III	<b>Semantic analysis and Discourse Processing:</b> Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.								<b>12</b>	
IV	<b>Natural Language Generation:</b> 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.								<b>12</b>	
V	<b>Information retrieval and lexical resources:</b> 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.								<b>12</b>	
<b>Total hours</b>								<b>60</b>		
<b>Course Outcomes</b>								<b>Programme Outcomes</b>		
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 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.

#### Reference Books

1.	Pierre M. Nugues, —An Introduction to Language Processing with Perl and Prolog, Springer
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#### Web Resources

1.	<a href="https://en.wikipedia.org/wiki/Natural_language_processing">https://en.wikipedia.org/wiki/Natural_language_processing</a>
2.	<a href="https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP">https://www.techtarget.com/searchenterpriseai/definition/natural-language-processing-NLP</a>

#### 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	2	3	3	3	2	3
CO 3	3	3	3	3	3	3
CO 4	3	2	3	3	2	3
CO 5	3	3	3	3	3	3
<b>Weightage of course contributed to each PSO</b>	14	14	15	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
	<b>Image Processing</b>	Elective	4	-	-	-	3	4	25	75	100
<b>Learning Objective</b>											
LO1	To learn fundamentals of digital image processing.										
LO2	To learn about various 2D Image transformations										
LO3	To learn about various image enhancement processing methods and filters										
LO4	To learn about various classification of Image segmentation techniques										
LO5	To learn about various image compression techniques										
UNIT	Contents										No. of Hours
I	<b>Digital Image Fundamentals:</b> Image representation - Basic relationship between pixels, Elements of DIP system -Applications of Digital Image Processing - 2D Systems - Classification of 2D Systems - Mathematical Morphology- Structuring Elements- Morphological Image Processing - 2D Convolution - 2D Convolution Through Graphical Method -2D Convolution Through Matrix Analysis										12
II	2D Image transforms: Properties of 2D-DFT - Walsh transform - Hadamard transform- Haar transform- Discrete Cosine Transform- Karhunen-Loeve Transform -Singular Value Decomposition										12
III	Image Enhancement: Spatial domain methods- Point processing- Intensity transformations - Histogram processing- Spatial filtering- smoothing filter- Sharpening filters - Frequency domain methods: low pass filtering, high pass Filtering- Homomorphic filter.										12
IV	Image segmentation: Classification of Image segmentation techniques - Region approach – Clustering techniques - Segmentation based on thresholding - Edge based segmentation - Classification of edges- Edge detection - Hough transform- Active contour.										12
V	Image Compression: Need for compression -Redundancy- Classification of image- Compression schemes- Huffman coding- Arithmetic coding- Dictionary based compression -Transform based compression,										12
<b>Total</b>										<b>60</b>	

Course Outcomes		Programme Outcome
CO	On completion of this course, students will	
1	Understand the fundamental concepts of digital image processing.	PO1
2	Understand various 2D Image transformations	PO1, PO2
3	Understand image enhancement processing techniques and filters	PO4, PO6
4	Understand the classification of Image segmentation Techniques	PO4, PO5, PO6
5	Understand various image compression techniques	PO3, PO5
<b>Text Book</b>		
1	S Jayaraman, S Esakkirajan, T Veerakumar, Digital image processing ,Tata McGraw Hill, 2015	
2	Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009	
<b>Reference Books</b>		
1.	Jain Anil K , Fundamentals of digital image processing: , PHI,1988	
2.	Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003	
3.	Pratt William K , Digital Image Processing: , John Wiley,4/e,2007	
<b>Web Resources</b>		
1.	<a href="https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf">https://kanchiuniv.ac.in/coursematerials/Digital%20image%20processing%20-Vijaya%20Raghavan.pdf</a>	
2.	<a href="http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf">http://sdeuoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez%2C%20R.%20Woods-ilovepdf-compressed.pdf</a>	
3.	<a href="https://dl.acm.org/doi/10.5555/559707">https://dl.acm.org/doi/10.5555/559707</a>	
4.	<a href="https://www.ijert.org/image-processing-using-web-2-0-2">https://www.ijert.org/image-processing-using-web-2-0-2</a>	

#### Mapping with Programme Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	3	3	2	3	2	2
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>10</b>	<b>10</b>

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
CC13	Computer Networks	Core	6	-	-	-	4	6	25	75	100
<b>Course Objective</b>											
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 Transport Protocols (ITP) - Network Security: Cryptography										18
	<b>Total</b>										<b>90</b>
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										PO1, PO2

	network	
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
<b>Text Book</b>		
1	A. S. Tanenbaum, —Computer Networks, 4th Edition, Prentice-Hall of India, 2008.	
<b>Reference Books</b>		
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. Gallager, —Data Networks, 2nd Edition, PHI, 2008.	
4.	Lamarca, –Communication Networks, Tata McGraw- Hill, 2002	
<b>Web Resources</b>		
1.	<a href="https://en.wikipedia.org/wiki/Computer_network">https://en.wikipedia.org/wiki/Computer_network</a>	
2.	<a href="https://citationsy.com/styles/computer-networks">https://citationsy.com/styles/computer-networks</a>	

### 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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>11</b>	<b>11</b>	<b>12</b>	<b>10</b>	<b>13</b>

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
	<b>.Net Programming</b>	Core	6	-	-	-	4	6	25	75	100
<b>Course Objective</b>											
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 standard controls.										
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 – String operations.										18
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.										18
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 Deleting files – File uploading.										18
IV	ADO.NET Overview – Database Connections – Commands – Data Reader - Data Adapter - Data Sets - Data Controls and its Properties – DataBinding										18
V	Grid View control: Deleting, editing, Sorting and Paging. XML classes – Web form to manipulate XML files - Website Security - Authentication - Authorization – Creating a Web application.										18
<b>Total</b>										<b>90</b>	

<b>Course Outcomes</b>		<b>Programme Outcome</b>
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
<b>Text Book</b>		
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.	
<b>Reference Books</b>		
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.	
<b>Web Resources</b>		
1.	<a href="https://www.geeksforgeeks.org/introduction-to-net-framework/">https://www.geeksforgeeks.org/introduction-to-net-framework/</a>	
2.	<a href="https://www.javatpoint.com/net-framework">https://www.javatpoint.com/net-framework</a>	

**Mapping with Programme Outcomes:**

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

**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
	<b>.Net Programming LAB</b>	Core	-	-	6	-	4	6	40	60	100
<b>Course Objective</b>											
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										90
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	
<b>Total</b>		<b>90</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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
<b>Text Book</b>		
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.	
<b>Reference Books</b>		
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.	
<b>Web Resources</b>		
1.	<a href="https://www.geeksforgeeks.org/introduction-to-net-framework/">https://www.geeksforgeeks.org/introduction-to-net-framework/</a>	
2.	<a href="https://www.javatpoint.com/net-framework">https://www.javatpoint.com/net-framework</a>	

**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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

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

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst.Hours	Marks	
									External	Total
	<b>RDBMS with PL /SQL</b>	Elective	5	-	-	-	3	5	75	
<b>Course Objective</b>										
LO1	Describe basic concepts of database system									
LO2	Design a Data model and Schemas in RDBMS									
LO3	Competent in use of SQL									
LO4	Analyze functional dependencies for designing robust Database									
LO5	Describe basic concepts of database system									
UNIT	Details									No. of Hours
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 Data Model- 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
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
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,P O2
3	Understand Competent use of SQL	PO4,P O6

4	Analyze functional dependencies for designing Robust Database	PO4,PO5,PO6
5	Understand basic concepts of database system	PO3,PO8
<b>Text Book</b>		
1	TEXT BOOK: .S.Sumathi,S.Esakkirajan,-Fundamentals of Relational Database Management System, Springer International Edition 2007.	
<b>Reference Books</b>		
2.	.Abraham Silberchatz, Henry F.Korth, S.Sudarshan,-Database System Concepts, McGraw Hill 2019, 7 <sup>th</sup> Edition.	
3.	Alexis Leon & Mathews Leon,-Fundamentals of DBMS, Vijay Nicole Publications 2014, 2 <sup>nd</sup> Edition.	
<b>Web Resources</b>		
1.	NPTEL & MOOC courses titled Relational Database Management Systems	
2.	<a href="https://nptel.ac.in/courses/106106093/">https://nptel.ac.in/courses/106106093/</a>	
3.	<a href="https://nptel.ac.in/courses/106106095/">https://nptel.ac.in/courses/106106095/</a>	



### 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
<b>Weightage of course Contributed to each PSO</b>	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
	<b>Internet of Things and its applications</b>	Elective	5	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
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									15	

	Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	
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 Gas Industry, 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
<b>Total</b>		<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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
<b>Text Book</b>		
1	Vijay Madiseti and Arshdeep Bahga, —Internet of Things: (A Hands-on Approach)ll, Universities Press (INDIA) Private Limited 2014, 1st Edition.	
<b>Reference Books</b>		
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	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice" 4..Cuno Pfister, —Getting Started with the Internet of Things, O'Reilly Media 2011
<b>Web Resources</b>	
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>
2.	<a href="https://www.javatpoint.com">https://www.javatpoint.com</a>
3.	<a href="https://www.w3schools.com">https://www.w3schools.com</a>

**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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>14</b>

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
	<b>Robotics and its Applications</b>	Elective	5	-	-	-	3	5	25	75	100
<b>Learning Objectives</b>											
LO1	To understand the robotics fundamentals										
LO2	Understand the sensors and matrix methods										
LO3	Understand the Localization: Self-localizations and mapping										
LO4	To study about the concept of Path Planning, Vision system										
LO5	To learn about the concept of robot artificial intelligence										
<b>UNIT</b>	<b>Details</b>									<b>No. of Hours</b>	
I	Introduction: Introduction, brief history, components of robotics, classification, workspace, work-envelop, motion of robotic arm, end-effectors and its types, service robot and its application, Artificial Intelligence in Robotics.									15	
II	Actuators and sensors :Types of actuators, stepper-DC-servo-and brushless motors- model of a DC servo motor-types of transmissions-purpose of sensor-internal and external sensor-common sensors-encoders tachometers-strain gauge based force torque sensor-proximity and distance measuring sensors Kinematics of robots: Representation of joints and frames, frames transformation, homogeneous matrix, D-H matrix, Forward and inverse kinematics: two link planar (RR) and spherical robot (RRP). Mobile robot Kinematics: Differential wheel mobile robot									15	
III	Localization: Self-localizations and mapping - Challenges in localizations – IR based localizations – vision based localizations – Ultrasonic based localizations - GPS localization systems.									15	
IV	Path Planning: Introduction, path planning-overview-road map path planning-cell decomposition path planning potential field path planning-obstacle avoidance-case studies Vision system: Robotic vision systems-image representation-object recognition-and categorization-depth measurement- image data compression-visual inspection-software considerations									15	
V	Application: Ariel robots-collision avoidance robots for agriculture-									15	

	mining-exploration-underwater-civilian- and military applications-nuclear applications-space Applications-Industrial robots-artificial intelligence in robots-application of robots in material handling-continuous arc welding-spot welding-spray painting-assembly operation-cleaning-etc.	
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
CO	On completion of this course, students will	
CO1	Describe the different physical forms of robot architectures.	PO1
CO2	Kinematically model simple manipulator and mobile robots.	PO1, PO2
CO3	Mathematically describe a kinematic robot system	PO4, PO6
CO4	Analyze manipulation and navigation problems using knowledge of coordinate frames, kinematics, optimization, control, and uncertainty.	PO4, PO5, PO6
CO5	Program robotics algorithms related to kinematics, control, optimization, and uncertainty.	PO3, PO8
<b>Text Book</b>		
1	RichardD.Klafter. Thomas Achmielewski and MickaelNegin, Robotic Engineering and Integrated Approach, Prentice Hall India-Newdelhi-2001	
2	SaeedB.Nikku, Introduction to robotics, analysis, control and applications, Wiley-India, 2 nd edition 2011	
<b>Reference Books</b>		
1.	Industrial robotic technology-programming and application by M.P.Groover et.al, McGrawhill2008	
2.	Robotics technology and flexible automation by S.R.Deb, THH-2009	
<b>Web Resources</b>		
1.	<a href="https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm">https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm</a>	
2.	<a href="https://www.geeksforgeeks.org/robotics-introduction/">https://www.geeksforgeeks.org/robotics-introduction/</a>	

**Mapping with Programme Outcomes:**

<b>CO/PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>Weightage ofcoursecontributedtoa chPSO</b>	<b>15</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>15</b>	<b>10</b>

S-Strong-3    M-Medium-2    L-Low-1

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>Elective</b>	<b>5</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>5</b>	<b>25</b>	<b>75</b>	<b>100</b>
<b>Learning Objectives</b>											
<b>LO1</b>	To define and highlight importance of software project management.										
<b>LO2</b>	To formulate and define the software management metrics & strategy in managing projects										
<b>LO3</b>	To famialarize in Software Project planning										
<b>LO4</b>	Understand to apply software testing techniques in commercial environment										
<b>Unit</b>	<b>Contents</b>										<b>No. of Hours</b>
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.										<b>15</b>
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.										<b>15</b>
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.										<b>15</b>
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.										<b>15</b>
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										<b>15</b>
<b>TOTAL</b>											<b>75</b>

<b>CO</b>	<b>Course Outcomes</b>
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
<b>Textbooks</b>	
1	Robert T. Futrell, Donald F. Shafer, Linda I. Safer, —Quality Software Project Management, Pearson Education Asia 2002.
<b>Reference Books</b>	
1.	PankajJalote, —Software Project Management in Practicell, Addison Wesley 2002.
2.	Hughes, —Software Project Management, Tata McGraw Hill 2004, 3rd Edition.
<b>NOTE: Latest Edition of Textbooks May be Used</b>	
<b>Web Resources</b>	
1.	Software Project Management e-resources from Digital libraries
2.	<a href="http://www.smartworld.com/notes/software-project-management">www.smartworld.com/notes/software-project-management</a>

**Mapping with Programme Outcomes:**

<b>MAPPING TABLE</b>						
<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO2</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>CO3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>
<b>CO5</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightageofcoursec ontributed toeachPSO</b>	<b>13</b>	<b>11</b>	<b>10</b>	<b>13</b>	<b>13</b>	<b>12</b>

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
	<b>Artificial Neural Networks</b>	Elective	5	-	-	-	3	5	25	75	100
<b>Learning Objectives</b>											
LO1	<b>Understand the basics of artificial neural networks, learning process, single layer And multi-layer perceptron networks.</b>										
LO2	Understand the Error Correction and various learning algorithms and tasks.										
LO3	Identify the various Single Layer Perception Learning Algorithm.										
LO4	Identify the various Multi-Layer Perception Network.										
LO5	Analyze the Deep Learning of various Neural network and its Applications.										
UNIT	Contents										No. of Hours
I	Artificial Neural Model- Activation functions- Feed forward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem - Multilayer Networks. Learning Algorithms- Error correction - Gradient Descent Rules, Perception Learning Algorithm, and Perception Convergence Theorem.										15
II	Introduction, Error correction learning, Memory-based learning, Hebbian learning, Competitive learning, Boltzmann learning, credit assignment problem, Learning with and without teacher, learning tasks, Memory and Adaptation.										15
III	.Single layer Perception: Introduction, Pattern Recognition, Linear classifier, Simple perception, Perception learning algorithm, Modified Perception learning algorithm, Adaptive linear combiner, Continuous perception, learning in continuous perception. Limitation of Perception.										15
IV	Multi-Layer Perception Networks: Introduction, MLP with 2 hidden layers, Simple layer of a MLP, Delta learning rule of the output layer, Multilayer feed forward neural network with continuous perceptions, Generalized delta learning rule, Back propagation algorithm										15
V	Deep learning- Introduction- Neuro architectures building blocks for the DL techniques, Deep Learning and Neocognitron, Deep Convolutional Neural Networks, Recurrent Neural Networks (RNN), feature extraction, Deep Belief Networks, Restricted Boltzman Machines, Training of DNN										15

	and Applications	
	<b>Total</b>	<b>75</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO1	<b>Students will learn the basics of artificial neural networks with single layer and multi-layer perception networks.</b>	PO1
CO2	Learn about the Error Correction and various learning algorithms and tasks.	PO1, PO2
CO3	Learn the various Perception Learning Algorithm.	PO4, PO5
CO4	Learn about the various Multi-Layer Perception Network.	PO4, PO5, PO6
CO5	Understand the Deep Learning of various Neural network and its Applications.	PO3, PO5
<b>Text Book</b>		
1	Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill- Second Edition.	
2.	—Neural Network- A Comprehensive Foundation - Simon Haykins, Pearson Prentice Hall, 2nd Edition, 1999.	
<b>Reference Books</b>		
1.	Artificial Neural Networks-B. Yegnanarayana, PHI, New Delhi 1998.	
<b>Web Resources</b>		
1.	<a href="https://www.w3schools.com/ai/ai_neural_networks.asp">https://www.w3schools.com/ai/ai_neural_networks.asp</a>	
2.	<a href="https://en.wikipedia.org/wiki/Artificial_neural_network">https://en.wikipedia.org/wiki/Artificial_neural_network</a>	
3.	<a href="https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12">https://link.springer.com/chapter/10.1007/978-3-642-21004-4_12</a>	

**Mapping with Programme Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	3	2	2
CO2	3	3	2	3	2	2
CO3	3	3	3	3	2	2
CO4	3	3	2	3	2	2
CO5	2	3	2	3	2	2
<b>Weightage of course contributed to each PSO</b>	<b>14</b>	<b>14</b>	<b>11</b>	<b>15</b>	<b>10</b>	<b>10</b>

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
	<b>Artificial Intelligence</b>	Elective	5	-	-	-	3	5	25	75	100
<b>Course Objective</b>											
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 estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning										15
<b>Total</b>										<b>75</b>	
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
<b>Text Book</b>		
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	
<b>Reference Books</b>		
1.	Trivedi, M.C., —A Classical Approach to Artificial 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	
<b>Web Resources</b>		
1.	<a href="https://github.com/dair-ai/ML-Course-Notes">https://github.com/dair-ai/ML-Course-Notes</a>	
2.	<a href="https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html">https://web.cs.hacettepe.edu.tr/~erkut/ain311.f21/index.html</a>	
3.	<a href="https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXIRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE">https://www.toolify.ai/?gclid=CjwKCAjwvdajBhBEEiwAeMh1U6tlqU1LXIRFbcghLMZVwICm_4PkIRcDRE-VYq_wTDcuaQeq_bCHnhoCcm4QAvD_BwE</a>	

### 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
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>

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
	<b>Advanced Excel</b>	Professional Competency Skill	2	-	-	-	2	2	25	75	100
<b>Learning Objectives</b>											
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									6	
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.									6	
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.									6	

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.	6
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.	6
<b>Total</b>		<b>30</b>
<b>Course Outcomes</b>		<b>Programme Outcomes</b>
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, PO8
<b>Text Book</b>		
1	<b>Excel 2019 All</b>	
2	<b>Microsoft Excel 2019 Pivot Table Data Crunching</b>	
<b>Reference Books</b>		
1	Excel 2019 All-in-One for Dummies, Greg Harvey, 1st edition	
<b>Web Resources</b>		
1.	<a href="https://www.simplilearn.com">https://www.simplilearn.com</a>	
2	<a href="https://www.javatpoint.com">https://www.javatpoint.com</a>	
3	<a href="https://www.w3schools.com">https://www.w3schools.com</a>	

**Mapping with Programme Outcomes:**

<b>CO/ PSO</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>	<b>PSO 4</b>	<b>PSO 5</b>	<b>PSO 6</b>
<b>CO1</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO4</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>CO5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Weightage of course contributed to each PSO</b>	<b>15</b>	<b>12</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>15</b>

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

## **9. Teaching – Learning Process:**

The Teaching-Learning process for the B.Sc. Computer Science programme has been in alignment with the course objectives and outcomes put forth for the programme. It has been ensured that the process is in compliance with the Programme Specific Outcomes and Course Outcomes envisaged for the programme. To enable effective and efficient teaching process various teaching aids have been used including online classes through Google Meet. To facilitate better learning process for the students the Institution has offered online repository such as Google Classroom for online sharing of reading resources and contents to the students.

To meet the set objectives of the course and enable students achieve the expected outcomes of the course the following teaching processes are utilized:

### **Class Room Teaching:**

Time tested regular Class room teaching and face-to-face teaching using chalk and talk method is used to imbibe the theoretical foundations to the students. Using Live Classroom teaching provides teachers with a handle to monitor the mindset of the students and grasp of the teaching. LCD/Projectors can be used in classroom for providing simulated/animated explanations of the concepts of the curriculum.

### **Laboratory Teaching:**

Laboratory Teaching provides hands-on practical sessions for the students to have deep understanding of the theoretical concepts that they learn in classrooms. Laboratory is furnished with state-of-the-art technologies and higher-end software to help students to solve the problems practically.

### **Forums:**

Student forum in the name of Career.Skills is organized every week where Industry experts are invited to provide Guest Lectures for the students to learn the latest trends and technologies prevalent in the industry. Forums are also used for peer-to-peer learning as students take seminars, involve themselves in group discussions on technical topics.

### **MOOCS:**

Students are advised to take up MOOC course such as NPTEL and other industry endorsed online courses to provide blended learning to cater to the needs of the ever-evolving field of Computer Science.

### **Project:**

Students are subjected to carryout Project-based assignments for every core subject. Students are given a real-time problem. They are to apply the theoretical concepts to the problems, analyse the technical details of the problem, evaluate the possible solutions to the problem and have to propose a



computational solution for the given problem.

Final year students in their final semester are mandated to complete a real-time mini-project for the successful completion of the degree.

### **Assignments:**

Home assignments are regularly given to students that comprises of

- Data collection from real-world to prepare themselves to gain insights to the data by comparing the data from various sources and preparing a report for the collected data.
- Solve theoretical problems using practical approaches to provide exposure to real-world problems and industry practices.

### **10. Assessment Methods:**

Assessment methods play a pivotal role in evaluation of student's progress. More importantly the Assessments methods employed are structured in such a way that students can themselves introspect as to what is expected of them by the Institution and by the Industry. Assessment methods provide students with window to know where they lack as a learner and more importantly how to improve upon themselves from the inputs of the curriculum. In bachelors programme of Computer Science, the assessment and evaluation method focus on testing the intuitive understanding of the fundamental concepts of software and hardware along with programming skills in various languages and more importantly the ability to apply the knowledge to real-life applications. The assessment methods try to validate and enhance the well-rounded skillsets of the students such as employable skills, entrepreneurship skills, research-relevance skills and programming-conscious skills.

#### **10.1. Continuous Assessment:**

The Continuous assessment occurs on a regular and continuous basis, it is an ongoing formative and summative process, involving the monitoring of students. This assessment is inherently integrated with teaching and involves of series of process like systematic collection of marks or grades that gradually flow into the final score. The assessment marks or grades collected through various stages of the semester eventually contribute to the final grade of the students.

The continuous Assessment process tests the students on various grounds and aspects such as:

- Continuous Internal Assessment – I
- Continuous Internal Assessment – II
- Continuous Internal Assessment – III
- Attendance
- Class Participation or seminars

- Assignments

The student is subjected to three internal assessment written exams in a semester. The student's regular class attendance proves to be an important factor in the evaluation of the student's credentials. The assessment also takes cognizance of the student's active participation in the class room discussions in the form of seminars and group discussions. The prompt submission of home assignments is monitored for assessing the student's final evaluation of their credentials. The overall marks secured in the Continuous Assessment Process contributes for 25% of the total marks secured in the end-semester examinations.

**11. Keywords:**

Learning Outcome, Graduate Descriptor, Qualification Descriptor, Skill Enhancement, Core Compulsory Courses, Discipline Specific Elective, Continuous Assessment, Assessment methods, CO, PSO, Teaching-Learning process