



Annamalai University
Faculty of Science

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

M. Sc. Computer Science (TANSICHE syllabus)

Programme Code: SCIS21

These rules and regulations shall govern the Two year post graduate studies leading to the award of degree of **Master of Science in Computer Science** in the Faculty of Science. These academic Regulations shall be called “**Annamalai University, Faculty of Science Two year M.Sc. Computer Science Regulations 2023**”. They shall come into force with effect from the academic year 2023 – 2024.

1. Definitions and Nomenclature

- 1.1 **University** refers to Annamalai University.
- 1.2 **Department** means any of the academic departments and academic centers at the University.
- 1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Computer Science is a discipline in Science, while Economics is a discipline in Social Sciences.
- 1.4 **Programme** encompasses the combination of courses and/or requirements leading to a degree. For example, M.A., M.Sc.
- 1.5 **Course** is an individual subject in a programme. Each course may consist of Lectures / Laboratory / Seminar / Project work / viva-voce etc. Each course has a course title and is identified by a course code.
- 1.6 **Curriculum** encompasses the totality of student experiences that occur during the educational process.
- 1.7 **Syllabus** is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.
- 1.8 **Academic Year** refers to the annual period of sessions of the University that comprises two consecutive semesters.
- 1.9 **Semester** is a half-year term that lasts for a minimum duration of 90 days.
- 1.10 **Choice Based Credit System:** A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.
- 1.11 **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.
- 1.12 **Credit Hour** refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular course.
- 1.13 **Programme Outcomes (POs)** are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.
- 1.14 **Programme Specific Outcomes (PSOs)** are statements that list what the graduate of a specific programme should be able to do at the end of the programme.
- 1.15 **Course Objectives** are statements that define the expected goal of a course in terms of demonstrable skills or knowledge that will be acquired by a student.
- 1.16 **Course Outcomes (COs)** are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

- 1.17 **Grade Point Average (GPA)** is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3
- 1.18 **Cumulative Grade Point Average (CGPA)** is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters is given in section 11.4.
- 1.19 **Letter Grade** is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2. **Programme Offered and Eligibility Criteria:**

The Department of Computer and Information Science offers a Two Year M.Sc. in Computer Science programme. A pass in any Bachelor's degree programme of minimum 3 years duration with Mathematics as any of the core/ancillary course at Graduate level or an examination accepted by the Syndicate of Annamalai University as equivalent thereto are eligible for admission.

- 2.1 In the case of SC/ST and Differently-abled candidates, a pass is the minimum qualification for all the above Programmes.

3. **Reservation Policy:** Admission to the various programmes will be strictly based on the reservation policy of the Government of Tamil Nadu.

4. **Programme Duration**

- 4.1 The Two Year Master's Programme consist of two academic years.
- 4.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.
- 4.3 Each semester will have 90 working days (18 weeks).

5. **Programme Structure**

- 5.1 The Two Year Master's Programme consists of Core Courses, Elective Courses (Discipline Centric/Generic), Project, Skill Enhancement Course, Internship/industrial visit and extension activity.

5.2 **Core courses**

- 5.2.1 Core Course is mandatory and an essential requirement to qualify for the Degree.
- 5.2.2 These are a set of compulsory courses essential for each programme.
- 5.2.3 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

5.3 **Project**

- 5.3.1 Each student shall undertake a Project and submit a dissertation as per guidelines in the final semester.
- 5.3.2 The Head of the Department shall assign a Research Supervisor/Project Guide to the student.
- 5.3.3 The Research Supervisor/Project Guide shall assign a topic for research and monitor the progress of the student periodically.
- 5.3.4 Students who wish to undertake project work in recognized institutions/industry shall obtain prior permission from the Department. The Research Supervisor/Project Guide will be from the host institute/Department.

5.4 **Elective courses**

- 5.4.1 **Generic/Discipline Centric** is a course that a student can choose from a range of alternatives.

5.5 **Internship/Industrial Activity (Experiential Learning)**

- 5.5.1 Experiential learning in the form of internship/industrial activity provides opportunities to students to connect principles of the discipline with real-life situations.
- 5.5.2 In-plant training/field trip/internship/industrial visit fall under this category.
- 5.5.3 Experiential learning is categorized as non-core course.

5.6 **Industry/Entrepreneurship**

This course is to introduce students to the activity of setting up a business or businesses, taking on

financial risks in the hope of profit.

5.7 **Skill Enhancement Course (SEC):** is a course designed to provide value-based or skill-based knowledge. The main purpose of this course is to provide students with skills in the hands-on-mode to increase their employability.

5.8 **Extension Activity** The basic objective of extension activity is to create social awareness among the students by providing the opportunities to work with people and also to create an awareness and knowledge of social realities to have concern for the welfare of the community and engage in creative and constructive societal development.

5.8.1 It is mandatory for every student to participate in extension activity.

5.8.2 All the students should enroll under NSS/NCC/CYRC/RRC or any other service organization in the University.

5.8.3 Students should put a minimum attendance of 40 hours in a year duly certified by the Programme Co-Ordinator.

5.8.4 Extension activity shall be conducted outside the class hours.

5.8.5 Extension activity is categorized as non-core course.

5.9 **Value Added Course (VAC)**

5.9.1 Students may opt to take Value Added Course beyond the minimum credits required for the award of the degree. VACs are outside the normal credit paradigm.

5.10 **Online Courses**

5.10.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

5.10.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

5.11 **Credit Distribution:** The credit distribution is organized as follows:

Component	Course	Credits
Part A	Core (Theory)	45
	Core (Practical)	12
	Project with Viva voce	7
Part B (i)	Elective (Generic/Discipline Centric)	18
Part B (ii)	Internship/Industrial Visit	02
Part B (iii)	Skill Enhancement Course/Professional Competency Skill	06
Part C	Extension Activity	01
	TOTAL CREDITS	91

Part A component and Part B (i) will be taken into account for CGPA calculation for the post graduate programme and the other components of Part B and Part C will not be included for CGPA calculation and have to be completed during the duration of the programme as per norms, to be eligible for obtaining the PG degree.

5.12 **Credit Assignment**

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one hour duration per week over a semester

1 Tutorial period of one hour duration per week over a semester

1 Practical/Project period of two hours duration per week over a semester.

6 **Attendance**

6.1 Each faculty handling a course shall be responsible for the maintenance of Attendance and Assessment Record for candidates who have registered for the course.

6.2 The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organization of lesson plan of the Course teacher.

- 6.3 The record shall be submitted to the Head of the Department and Dean once a month for monitoring the attendance and syllabus coverage.
- 6.4 At the end of the semester, the record shall be placed in safe custody for any future verification.
- 6.5 The Course teacher shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.
- 6.6 Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to redo the semester in the next year.
- 6.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

7 Mentor-Mentee System

- 7.1 To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.
- 7.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.
- 7.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

8 Examinations

- 8.1 The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).
- 8.2 There will be two CIA Tests and one ESE in each semester.
- 8.3 The Question Papers will be framed to test different levels of learning based on Bloom's taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

8.4 Continuous Internal Assessment Tests

- 8.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments and seminars. This requires an element of openness.
- 8.4.2 The students are to be informed in advance about the assessment procedures.
- 8.4.3 The pattern of question paper will be decided by the respective faculty.
- 8.4.4 CIA Tests will be for one- or two-hours duration depending on the quantum of syllabus.
- 8.4.5 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.
- 8.4.6 For the CIA Tests, the assessment will be done by the Course teacher

8.5 End Semester Examinations (ESE)

- 8.5.1 The ESE for the first and third semester will be conducted in November and for the second and fourth semester in May.
- 8.6 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.
- 8.7 The ESE will be of three hours duration and will cover the entire syllabus of the course.

9 Evaluation

9.1 Marks Distribution

- 9.1.1 For each course, the Theory, Practical and project shall be evaluated for a maximum of 100 marks.
- 9.1.2 For the theory courses, CIA Tests will carry 25% and the ESE 75% of the marks.
- 9.1.3 For the Practical courses, the CIA Tests will carry 25% and the ESE 75% of the marks.

9.2 Assessment of CIA Tests

9.2.1 For the CIA Tests, the assessment will be done by the Course Instructor

9.2.2 For the Theory Courses, the break-up of marks shall be as follows:

	Marks
Test-I and Test-II	15
Seminar	5
Assignment	5
Total	25

9.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

	Marks
Test-I	10
Test-II	10
Viva-voce and Record	05
Total	25

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by internal examiners.

9.4 Assessment of Project/Dissertation

9.4.1 The Project Report/Dissertation shall be submitted as per the guidelines.

9.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

9.4.4 The Project Report evaluation and viva-voce will be conducted by a committee constituted by the Head of the Department.

9.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

9.4.6 The marks shall be distributed as follows:

Continuous Internal Assessment (25 Marks)		End Semester Examination (75 Marks)	
Review-I - 10	Review-II -15	Project / Dissertation Evaluation	Vivavoce
		50	25

9.5 Assessment of Value-added Courses

9.5.1 Assessment of VACs shall be internal. Two CIA Tests shall be conducted during the semester by the Department(s) offering VAC.

9.5.2 The grades obtained in VACs will not be included for calculating the GPA/CGPA.

9.6 Passing Minimum

9.6.1 A student is declared to have passed in each course if he/she secures not less than 50% marks in the ESE and not less than 50% marks in aggregate taking CIA and ESE marks together.

9.6.2 A candidate who has not secured a minimum of 50% of marks in a course (CIA + ESE) shall reappear for the course in the next semester/year.

10. Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

11. Marks and Grading

11.1 The performance of students in each course is evaluated in terms Grade Point (GP).

11.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed.

11.3 **The GPA** is calculated by the formula

$$GPA = \frac{\sum_{i=1}^n C_i G_i}{\sum_{i=1}^n C_i}$$

where, C_i is the Credit earned for the Course i in any semester;

G_i is the Grade Point obtained by the student for the Course i and

n is the number of Courses passed in that semester.

11.4 **CGPA** is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

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

Where, C_i is the Credit earned for the Course i in any semester;

G_i is the Grade Point obtained by the student for the Course i and

n is the number of Courses passed in that semester.

m is the number of semesters.

11.5 Evaluation:

11.5.1 **Performance of the student for each course will be rated as shown in the Table.**

Range of Marks	Grade Points	Letter Grade
90 and above	10	S
80-89	9	A
70-79	8	B
60-69	7	C
55-59	6	D
50-54	5	E
Less than 50	0	RA
Withdrawn from the examination	0	W

11.5.2 A ten-point rating scale is used for evaluation of the performance of the student to provide overall grade for the Master's Programme.

CGPA	CLASSIFICATION OF FINAL RESULT
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0.0 and above but below 5.0	Re-appear

11.6 **Classification of Results.** The successful candidates are classified as follows:

11.6.1 **For First Class with Distinction:** Candidates who have passed all the courses prescribed in the

Programme in the first attempt with a CGPA of 8.25 and above within the programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (See Section 12 for details).

- 11.6.2 **For First Class:** Candidates who have passed all the courses with a CGPA of 6.5 and above.
- 11.6.3 **For Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.
- 11.6.4 Candidates who obtain overall highest CGPA in all examinations in the first appearance itself are eligible for University Rank.
- 11.6.5 **Formula for Conversion of CGPA into Percentage**
 $CGPA \times 9.5 = \text{Percentage}$
- 11.7 **Course-Wise Letter Grades**
- 11.7.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.
- 11.7.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.
- 11.7.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point
- 11.7.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade sheet of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.
- 11.7.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

12. **Provision for Withdrawal from the End Semester Examination**

- 12.1 The letter grade W indicates that a candidate has withdrawn from the examination.
- 12.2 A candidate is permitted to withdraw from appearing in the ESE for one course or courses in ANY ONE of the semesters ONLY for exigencies deemed valid by the University authorities.
- 12.3 Permission for withdrawal from the examination shall be granted only once during the entire duration of the programme.
- 12.4 Application for withdrawal shall be considered only if the student has registered for the course(s), and fulfilled the requirements for attendance and CIA tests.
- 12.5 The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days notice, due consideration will be given under extraordinary circumstances.
- 12.6 Withdrawal will not be granted for arrear examinations of courses in previous semesters and for the final semester examinations.
- 12.7 Candidates who have been granted permission to withdraw from the examination shall reappear for the course(s) when the course(s) are offered next.
- 12.8 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.

- 13. **Academic misconduct:** Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitized on issues of academic integrity and ethics.

- 14. **Transitory Regulations:** Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the

recommendation of the Head of the Department concerned.

15. Notwithstanding anything contained in the above pages as Rules and Regulations governing the Two-Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.

CONTENTS

- i. PO and PSO Description
- ii. PG – Template
- iii. Methods of Evaluation & Methods of Assessment
- iv. Semester Index.
- v. Subjects – Core, Elective, Nonmajor, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency
 - 1) Course Lesson Box
 - 2) Course Objectives
 - 3) Units
 - 4) Learning Outcome
 - 5) Reference and Text Books
 - 6) Web Sources
 - 7) PO & PSO Mapping tables

TANSICHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR POSTGRADUATE EDUCATION	
Programme	M.Sc., Computer Science
Programme Code	SCIS21
Duration	PG - Two Years
Programme Outcomes (Pos)	<p>PO1: Problem Solving Skill Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p>PO2: Decision Making Skill Foster analytical and critical thinking abilities for data-based decision-making.</p> <p>PO3: Ethical Value Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p>PO4: Communication Skill Ability to develop communication, managerial and interpersonal skills.</p> <p>PO5: Individual and Team Leadership Skill Capability to lead themselves and the team to achieve organizational goals.</p> <p>PO6: Employability Skill Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p>PO7: Entrepreneurial Skill Equip with skills and competencies to become an entrepreneur.</p> <p>PO8: Contribution to Society Succeed in career endeavors and contribute significantly to society.</p> <p>PO 9 Multicultural competence Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p> <p>PO 10: Moral and ethical awareness/reasoning Ability to embrace moral/ethical values in conducting one's life.</p>
Programme Specific Outcomes (PSOs)	<p>PSO1 – Placement To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p>PSO 2 - Entrepreneur To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p>PSO3 – Research and Development</p>

	<p>Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p>PSO4 – Contribution to Business World To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p>PSO 5 – Contribution to the Society To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>
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Credit Distribution for PG Programme

Semester-I	Credit	Semester-II	Credit	Semester-III	Credit	Semester-IV	Credit
1.1. Core-I	5	2.1. Core-IV	5	3.1. Core-VII	5	4.1. Core-XI	5
1.2 Core-II	5	2.2 Core-V	5	3.2 Core-VII	5	4.2 Core-XII	5
1.3 Core – III	4	2.3 Core – VI	4	3.3 Core – IX	5	4.3 Project with Viva-Voce	7
1.4 Elective (Generic / Discipline Centric)- I	3	2.4 Elective (Generic / Discipline Centric) – III	3	3.4 Core-X Industry Module	4	4.4 Elective (Generic / Discipline Centric) – VI	3
1.5 Elective (Generic / Discipline Centric)-II	3	2.5 Elective (Generic / Discipline Centric)-IV	3	3.5 Elective (Generic / Discipline Centric) – V	3	4.5 Skill Enhancement Course - Professional Competency Skill SEC 3	2
		2.6 Skill Enhancement Course SEC 1	2	3.6 Skill Enhancement Course – Term Paper and Seminar Presentation SEC 2	2	4.6 Extension Activity	1
				3.7 Internship/ Industrial Activity	2		
	20		22		26		23
	Total Credit Points						91

Core&Elective Papers	= 82
Skill Enhancement Courses	= 06
Internship/ Industrial Activity	= 2
Extension Activity	= 1
Total Credits	<u>91</u>

Component wise Credit Distribution

Credits	Sem I	Sem II	Sem III	Sem IV	Total
Part A					
(i) Core and (ii) Elective	20	20	22	20	82
Part B					
(i) Skill Enhancement Courses	-	2	2	2	6
(ii) Summer Internship/Industrial Training	-	-	2	-	2
Part C					
Extension Activity				1	1
Total	20	22	26	23	91

METHODS OF EVALUATION		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments / Snap Test / Quiz	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
Total		100 Marks
METHODS OF ASSESSMENT		
Remembering (K1)	<ul style="list-style-type: none"> • The lowest level of questions requires students to recall information from the course content • Knowledge questions usually require students to identify information in the text book. 	
Understanding (K2)	<ul style="list-style-type: none"> • Understanding of facts and ideas by comprehending, organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together 	
Application (K3)	<ul style="list-style-type: none"> • Students have to solve problems by using/applying a concept learned in the classroom. • Students must use their knowledge to determine an exact response. 	
Analyze (K4)	<ul style="list-style-type: none"> • Analyzing the question is one that asks the students to break down something into its component parts. • Analyzing requires students to identify reasons, causes or motives and reach conclusions or generalizations. 	
Evaluate (K5)	<ul style="list-style-type: none"> • Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem-solving. • Evaluation questions do not have a single right answer. 	
Create (K6)	<ul style="list-style-type: none"> • The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem-solving skills 	

**PROGRAMME OUTCOMES (PO) - PROGRAMME SPECIFIC OUTCOMES (PSO)
MAPPING**

PROGRAMME SPECIFIC OUTCOMES (PSO)					
	PO1	PO2	PO3	PO4	PO5
PSO1	3	3	3	3	3
PSO2	3	3	3	3	3
PSO3	3	3	3	3	3
PSO4	3	3	3	3	3
PSO5	3	3	3	3	3

Level of Correlation between PO's and PSO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0 – No Correlation

CURRICULUM AND SCHEME OF EXAMINATIONS
M.Sc. Computer Science (Two year programme)
Programme Code: SCIS21

Programme Structure
(For students admitted from the academic year 2023-2024)

Course Code	Title of the Course	Credits	Hours	Maximum Marks		
				CIA	ESE	Total
FIRST SEMESTER						
23CSCC101	Core - I: Analysis & Design of Algorithms	5	7	25	75	100
23CSCC102	Core – II: Object Oriented Analysis and Design & C++	5	7	25	75	100
23CSCC103	Core – III: Python Programming	4	6	25	75	100
23CSCE104	Elective - I	3	5	25	75	100
23CSCP105	Elective – II	3	5	25	75	100
Total		20	30			500
SECOND SEMESTER						
23CSCC201	Core - IV: Data Mining and Warehousing	5	6	25	75	100
23CSCC202	Core – V: Advanced Operating Systems	5	6	25	75	100
23CSCC203	Core - VI Advanced Java Programming	4	6	25	75	100
23CSCE204	Elective – III	3	4	25	75	100
23CSCE205	Elective –IV	3	4	25	75	100
23CSCS206	Skill Enhancement Course (SEC) - I	2	4	25	75	100
Total		22	30			600

THIRD SEMESTER						
23CSCC301	Core - VII: Digital Image Processing	5	6	25	75	100
23CSCC302	Core – VIII: Cloud Computing	5	6	25	75	100
23CSCC303	Core – IX: Network Security and Cryptography	5	6	25	75	100
23CSCC304	Core - X: Data Science & Analytics	4	6	25	75	100
23CSCE305	Elective–V	3	3	25	75	100
23CSCS306	Skill Enhancement Course (SEC) - II	2	3	25	75	100
23CSCI307	Internship / Industrial Activity	2				100
Total		26	30			700
FOURTH SEMESTER						
23CSCP401	Core – XI: Python Programming Lab	5	6	25	75	100
23CSCP402	Core – XII: Web Application development & hosting Lab	5	6	25	75	100
23CSCD403	Project work and Viva-Voce	7	10	25	75	100
23CSCE404	Elective-VI	3	4	25	75	100
23CSCS405	Skill Enhancement Course (SEC) - III	2	4	25	75	100
23CSCX406	Extension Activity	1				
Total		23	30			500
Grand Total		91	120	2300		

ELECTIVE COURSES

Course Code	Title of the Course
Elective – I (First Semester)	
23CSCE104	Advanced Software Engineering
	Multimedia and Its Applications
Elective – II (First Semester)	
23CSCE105	Algorithm and OOPS Lab
	Cyber Security Lab
Elective – III (Second Semester)	
23CSCE204	Artificial Intelligence & Machine Learning
	Critical Thinking, Design Thinking and Problem Solving
Elective – IV (Second Semester)	
23CSCE205	Internet of Things
	Mobile Computing
Elective – V (Third Semester)	
23CSCE305	Digital Image Processing Lab using MATLAB
	Block Chain Technology Lab
Elective – VI (Fourth Semester)	
23CSCE404	Web Services
	Robotic Process Automation For Business

SKILL ENHANCEMENT COURSES

Course Code	Title of the Course
Second Semester- SEC - I	
23CSCS206	Data Mining Lab using R Lab / Social Networking Lab
Third Semester -SEC - II	
23CSCS306	Cloud Computing Lab / Dot Net Technologies Lab
Fourth Semester - SEC - III	
23CSCS405	Machine Learning Lab / Natural Language Processing Lab

I – SEMESTER

Coursecode	23CSCC101	ANALYSIS&DESIGNOF ALGORITHMS	L	T	P	C
Core/Elective/Supportive		Core-I	7			5
Pre-requisite		BasicDataStructures& Algorithms				
CourseObjectives:						
Themain objectivesof thiscourseareto:						
<ol style="list-style-type: none"> 1. Enablethestudents tolearntheElementary DataStructuresandalgorithms. 2. Presentsanintroductiontothealgorithms,theiranalysisanddesign 3. DiscussvariousmethodslikeBasicTraversalAndSearchTechniques,divideandconquer method, Dynamic programming, backtracking 4. Understoodthevariousdesignandanalysisofthealgorithms. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Get knowledge about algorithms and determines their time complexity. Demonstrate specific search and sort algorithms using divide and conquer technique.					K1,K2
2	GaingoodunderstandingofGreedyMethodandits algorithm.					K2,K3
3	Abletodescribeaboutgraphsusingdynamicprogrammingtechnique.					K3,K4
4	Demonstratethe concept ofbacktracking&branchandboundtechnique.					K5,K6
5	Exploretetraversalandsearchingtechniqueandapplyitfortreesandgraphs.					K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				15hours	
Introduction: - Algorithm Definition and Specification – Space complexity-Time Complexity-Asymptotic Notations - Elementary Data Structure: Stacks and Queues – Binary Tree - Binary Search Tree - Heap – Heapsort- Graph.						
Unit:2	TRAVERSALANDSEARCHTECHNIQUES				15hours	
Basic Traversal And Search Techniques: Techniques for Binary Trees-Techniques for Graphs - Divide and Conquer: - General Method – Binary Search – Merge Sort – Quick Sort.						
Unit:3	GREEDY METHOD				15hours	
TheGreedyMethod:-GeneralMethod–KnapsackProblem–MinimumCostSpanningTree– Single Source Shortest Path.						

Unit:4	DYNAMICPROGRAMMING	15hours
DynamicProgramming-GeneralMethod–MultistageGraphs–AllPairShortestPath–Optimal Binary Search Trees – 0/1 Knapsacks – Traveling Salesman Problem – Flow Shop Scheduling.		
Unit:5	BACKTRACKING	Version 13hours
Backtracking:-GeneralMethod–8-QueensProblem–SumOfSubsets–GraphColoring– Hamiltonian Cycles – Branch And Bound: - The Method – Traveling Salesperson.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars– webinars		
TotalLecturehours		75hours
Text Books		
1	EllisHorowitz,“ComputerAlgorithms”,GalgotiaPublications.	
2	AlfredV.Aho,JohnE.Hopcroft,JeffreyD.Ullman,"DataStructuresandAlgorithms".	
ReferenceBooks		
1	Goodrich,“DataStructures&AlgorithmsinJava”,Wiley3rd edition.	
2	Skiena,“TheAlgorithmDesignManual”,SecondEdition,Springer,2008	
3	AnanyLevith,“IntroductiontotheDesignandAnalysisofalgorithm”,PearsonEducation Asia, 2003.	
4	RobertSedgewick,PhillipeFlajolet,“AnIntroductiontotheAnalysisofAlgorithms”, Addison-Wesley Publishing Company,1996.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://nptel.ac.in/courses/106/106/106106131/	
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm	
3	https://www.javatpoint.com/daa-tutorial	

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

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

I – SEMESTER

Coursecode	23CSCC102	OBJECTORIENTEDANALYSISAND DESIGN & C++	L	T	P	C
Core/Elective/Supportive	Core-II		7			5
Pre-requisite	BasicsofC++and Object-Oriented Concepts					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Presenttheobjectmodel,classesandobjects,objectorientation,machineviewandmodel management view. 2. Enablethestudentstolearnthebasicfunctions,principlesandconceptsofobject-oriented analysis and design. 3. EnablethestudentstounderstandC++languagewithrespecttoOOAD 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandtheconceptofObject-Orienteddevelopmentandmodelingtechniques				K1,K2	
2	Gainknowledgeaboutthevariousstepsperformedduringobjectdesign				K2,K3	
3	Abstractobject-basedviewsforgenericsoftwaresystems				K3	
4	LinkOOADwithC++ language				K4,K5	
5	ApplythebasicconceptofOOPsandfamiliarizetowriteC++ program				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	OBJECTMODEL				15hours	
The Object Model: The Evolution of the Object Model – Elements of the Object Model – Applying the Object Model. Classes and Objects: The Nature of an Object – Relationship among Objects.						
Unit:2	CLASSESANDOBJECTS				15hours	
Classes and Object: Nature of Class – Relationship Among classes – The Interplay of classes and Objects. Classification: The importance of Proper Classification –identifying classes and objects –Key Abstractions and Mechanism.						
Unit:3	C++INTRODUCTION				15hours	
IntroductiontoC++-InputandoutputstatementsinC++-Declarations-controlstructures– Functions in C++.						

Unit:4	INHERITANCEANDOVERLOADING	13hours
ClassesandObjects–ConstructorsandDestructors–operatoroverloading–Type Conversion- Inheritance – Pointers and Arrays.		
Unit:5	POLYMORPHISMANDFILES	15hours
MemoryManagementOperators-Polymorphism–Virtualfunctions–Files–Exception Handling – String Handling -Templates.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		75hours
Text Books		
1	“Object Oriented Analysis and Design with Applications”, Grady Booch, Second Edition, Pearson Education.	
2	“Object-OrientedProgrammingwithANSI&TurboC++”,AshokN.Kamthane,First Indian Print - 2003, Pearson Education.	
ReferenceBooks		
1	Balagurusamy“ObjectOrientedProgrammingwithC++”,TMH,SecondEdition,2003.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview	
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/	
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm	

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

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

I – SEMESTER

Coursecode	23CSCC103	PYTHONPROGRAMMING	L	T	P	C
Core/Elective/Supportive	Core-III		6			4
Pre-requisite	Basics of any OO Programming Language					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. PresentsanintroductiontoPython,creationofwebapplications,networkapplicationsand working in the clouds 2. UsefunctionsforstructuringPythonprograms 3. UnderstanddifferentDataStructuresofPython 4. RepresentcompounddatausingPythonlists,tuplesanddictionaries 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandthebasicconceptsofPythonProgramming				K1,K2	
2	UnderstandFileoperations,Classesand Objects				K2,K3	
3	AcquireObjectOrientedSkillsinPython				K3,K4	
4	DevelopwebapplicationsusingPython				K5	
5	DevelopClientServerNetworking applications				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				15hours	
Python: Introduction–Numbers–Strings–Variables–Lists–Tuples–Dictionaries–Sets– Comparison.						
Unit:2	CODESTRUCTURES				15hours	
Code Structures: if, elseif, and else – Repeat with while – Iterate with for – Comprehensions – Functions – Generators – Decorators – Namespaces and Scope – Handle Errors with try and except – User Exceptions.						
Unit:3	MODULES,PACKAGESANDCLASSES				15hours	
Modules, Packages, and Programs: Standalone Programs – Command-Line Arguments – Modules and the import Statement – The Python Standard Library. Objects and Classes: Define a Class with class – Inheritance – Override a Method – Add a Method – Get Help from Parent withsuper–InselfDefense –GetandSetAttributeValueswithProperties –NameManglingfor Privacy – Method Types – Duck Typing – Special Methods –Composition.						

Unit:4	DATATYPESANDWEB	13hours
DataTypes: TextStrings–BinaryData. StoringandRetrievingData: FileInput/Output– Structured Text Files – Structured Binary Files - Relational Databases – NoSQL Data Stores.		
Web: WebClients –Web Servers–WebServicesandAutomation		
Unit:5	SYSTEMSANDNETWORKS	15hours
Systems: Files–Directories–ProgramsandProcesses–CalendarsandClocks.		
Concurrency: Queues– Processes–Threads–GreenThreadsandgevent–twisted–Redis.		
Networks: Patterns – The Publish-Subscribe Model – TCP/IP – Sockets – ZeroMQ –Internet Services – Web Services and APIs – Remote Processing – Big Fat Data and MapReduce – Working in the Clouds.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		75hours
Text Books		
1	BillLubanovic,“IntroducingPython”,O’Reilly,FirstEdition-SecondRelease,2014.	
2	MarkLutz,“LearningPython”, O’Reilly,FifthEdition, 2013.	
ReferenceBooks		
1	David M. Beazley,“Python Essential Reference”, Developer’s Library, Fourth Edition,2009.	
2	SheetalTaneja,Naveen Kumar, “Python Programming-A Modular Approach”,PearsonPublications.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.programiz.com/python-programming/	
2	https://www.tutorialspoint.com/python/index.htm	
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview	

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

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

II – SEMESTER

Coursecode	23CSCC201	DATAMININGANDWAREHOUSING	L	T	P	C
Core/Elective/Supportive	Core-IV		6			5
Pre-requisite	BasicsofRDBMS&Algorithms					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Enable the students to learn the concepts of Mining tasks, classification, clustering and Data Warehousing. 2. Developskillsofusingrecentdataminingsoftwareforsolvingpracticalproblems. 3. Developandapplycriticalthinking,problem-solving,anddecision-makingskills. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Understandthebasicdataminingtechniquesandalgorithms					K1,K2
2	UnderstandtheAssociationrules,ClusteringtechniquesandDatawarehousingcontents					K2,K3
3	Compareandevaluatedifferentdataminingtechniqueslikeclassification,prediction, Clustering and association rule mining					K4,K5
4	DesigndatawarehousewithdimensionalmodelingandapplyOLAPoperations					K5,K6
5	Identifyappropriatedataminingalgorithmstosolvearealworldproblems					K6
K1-Remember;K2-Understand;K3-Apply; K4-Analyze;K5-Evaluate; K6-Create						
Unit:1						
BASICSANDTECHNIQUES			12hours			
Basic data mining tasks – data mining versus knowledge discovery in databases – data mining issues – data mining metrics – social implications of data mining – data mining from a database perspective.						
Data mining techniques: Introduction – a statistical perspective on data mining – similarity measures – decision trees – neural networks – genetic algorithms.						
Unit:2						
ALGORITHMS			12hours			
Classification:Introduction –Statistical –basedalgorithms -distance–basedalgorithms-decision tree-basedalgorithms-neuralnetwork–basedalgorithms–rule-basedalgorithms–combining techniques.						
Unit:3						
CLUSTERINGANDASSOCIATION			12hours			
Clustering:Introduction–SimilarityandDistanceMeasures–Outliers–HierarchicalAlgorithms -PartitionalAlgorithms.						
Association rules: Introduction - large item sets - basic algorithms – parallel &distributed algorithms – comparing approaches- incremental rules – advanced association rules techniques – measuring the quality of rules.						

Unit:4	DATA WAREHOUSING AND MODELING	11 hours
Data warehousing: introduction-characteristics of a data warehouse – data marts – other aspects of data mart. Online analytical processing: introduction - OLTP & OLAP systems		
Data modeling – star schema for multidimensional view – data modeling – multi-fact star schema or snowflake schema – OLAP TOOLS – State of the market – OLAP TOOLS and the internet.		
Unit:5	APPLICATIONS OF DATA WAREHOUSE	11 hours
Developing a data WAREHOUSE: why and how to build a data warehouse – data warehouse architectural strategies and organization issues - design consideration – data content – metadata distribution of data – tools for data warehousing – performance considerations – crucial decisions in designing a data warehouse.		
Applications of data warehousing and data mining in government: Introduction - national data warehouses – other areas for data warehousing and data mining.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
Total Lecture hours		60 hours
Text Books		
1	Margaret H. Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education, 2003.	
2	C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Products and Applications”, PHI, Second Edition.	
Reference Books		
1	Arun K. Pujari, “Data Mining Techniques”, Universities Press (India) Pvt. Ltd., 2003.	
2	Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining and OLAP”, TMCH, 2001.	
3	Jiawei Han & Micheline Kamber, “Data Mining Concepts & Techniques”, 2001, Academic Press.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.javatpoint.com/data-warehouse	
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/	
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html	

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

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

II – SEMESTER

Coursecode	23CSCC202	ADVANCED OPERATING SYSTEMS	L	T	P	C
Core/Elective/Supportive	Core-V		6			5
Pre-requisite	Basics of OS & its functioning					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Enable the student to learn the different types of operating systems and their functioning. 2. Gain knowledge on Distributed Operating Systems 3. Gain insight into the components and management aspects of real-time and mobile operating systems. 4. Learn case studies in Linux Operating Systems 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the design issues associated with operating systems				K1, K2	
2	Master various process management concepts including scheduling, deadlocks and distributed file systems				K3, K4	
3	Prepare Real Time Task Scheduling				K4, K5	
4	Analyze Operating Systems for Handheld Systems				K5	
5	Analyze Operating Systems like LINUX and iOS				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	BASICS OF OPERATING SYSTEMS				12 hours	
Basics of Operating Systems: What is an Operating System? – Main frame Systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks – Prevention – Avoidance – Detection – Recovery.						
Unit:2	DISTRIBUTED OPERATING SYSTEMS				12 hours	
Distributed Operating Systems: Issues – Communication Primitives – Lamport’s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems – design issues – Case studies – The Sun Network File System-Coda.						
Unit:3	REAL TIME OPERATING SYSTEM				10 hours	
Realtime Operating Systems : Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling						

Unit:4	HANDELD SYSTEM	12hours
Operating Systems for Handheld Systems: Requirements – Technology Overview – Handheld Operating Systems – PalmOS – Symbian Operating System – Android – Architecture of android – Securing handheld systems		
Unit:5	CASE STUDIES	12hours
Case Studies : Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
Total Lecture hours		60hours
Text Books		
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.	
2	Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.	
Reference Books		
1	Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.	
2	Pramod Chandra P. Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.	
3	Daniel P. Bovet & Marco Cesati, “Understanding the Linux kernel”, 3 rd edition, O’Reilly, 2005	
4	Neil Smyth, “iPhone/iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview	
2	https://www.udacity.com/course/advanced-operating-systems--ud189	
3	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf	

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

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

II – SEMESTER

Coursecode	23CSCC203	ADVANCEDJAVAPROGRAMMING	L	T	P	C
Core/Elective/Supportive	Core-VI		6			4
Pre-requisite	BasicsofJava&itsUsage					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Enablethestudentstolearnthebasicfunctions,principlesandconceptsofadvancedjavaprogramming. 2. ProvideknowledgeonconceptsneededfordistributedApplicationArchitecture. 3. LearnJDBC,Servletpackages,JQuery,JavaServerPagesandJARfileformat 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandtheadvancedconceptsofJava Programming					K1,K2
2	UnderstandJDBCandRMIconcepts					K2,K3
3	ApplyandanalyzeJavainDatabase					K3,K4
4	Handle different event in java using the delegation event model, event listener and class					K5
5	DesigninteractiveapplicationsusingJavaServlet, JSPandJDBC					K5,K6
K1-Remember;K2-Understand;K3-Apply; K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	BASICSOFJAVA				12hours	
JavaBasicsReview:Componentsandeventhandling–Threadingconcepts–Networkingfeatures – Media techniques						
Unit:2	REMOTEMETHOD INVOCATION				12hours	
Remote Method Invocation-Distributed Application Architecture- Creating stubs and skeletons-Defining Remote objects- Remote Object Activation-Object Serialization-Java Spaces						
Unit:3	DATABASE				10hours	
JavainDatabases-JDBCprinciples–databaseaccess-Interacting-databasesearch–Creating multimedia databases – Database support in web applications						
Unit:4	SERVLETS				12hours	
Java Servlets: Java Servlet and CGI programming- A simple java Servlet-Anatomy of a java Servlet-Readingdata from a client-Reading http request header-sending data to a client andwriting the http response header-working with cookies Java Server Pages: JSP Overview-Installation-JSP tags-Components of a JSP page-Expressions-Scriptlets-Directives-Declarations-A complete example						
Unit:5	ADVANCEDTECHNIQUES				12hours	
JARfileformatcreation–Internationalization–SwingProgramming–Advancedjavatechniques						

Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		60hours
Text Books		
1	JamieJaworski,“JavaUnleashed”,SAMSTechmediaPublications,1999.	
2	Campione, Walrath and Huml,“TheJavaTutorial”,AddisonWesley,1999.	
ReferenceBooks		
1	JimKeogh, ”TheCompleteReferenceJ2EE”,TataMcGrawHillPublishingCompanyLtd,2010.	
2	DavidSawyerMcFarland,“JavaScriptAndjQuery-TheMissingManual”,Oreilly Publications, 3rd Edition,2011.	
3	DeitelandDeitel, “JavaHowtoProgram”,ThirdEdition,PHI/PearsonEducationAsia.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.javatpoint.com/servlet-tutorial	
2	https://www.tutorialspoint.com/java/index.htm	
3	https://onlinecourses.nptel.ac.in/noc19_cs84/preview	

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

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

III SEMESTER

Coursecode	23CSCC301	DIGITALIMAGEPROCESSING	L	T	P	C
Core/Elective/Supportive	Core-VII		6			5
Pre-requisite	Basics of Image Processing					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Learn basic image processing techniques for solving real problems. 2. Gain knowledge in image transformation and image enhancement techniques. 3. Learn image compression and segmentation procedures. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the fundamentals of Digital Image Processing					K1, K2
2	Understand the mathematical foundations for digital image representation, image acquisition, image transformation, and image enhancement					K2, K3
3	Apply, Design and Implement and get solutions for digital image processing problems					K3, K4
4	Apply the concepts of filtering and segmentation for digital image retrieval					K4, K5
5	Explore the concepts of Multi-resolution process and recognize the objects in an efficient manner					K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
Introduction: What is Digital image processing – the origin of DIP – Examples of fields that use DIP – Fundamentals steps in DIP – Components of an image processing system. Digital Image Fundamentals: Elements of Visual perception – Light and the electromagnetic spectrum – Image sensing and acquisition – Image sampling and Quantization – Some Basic relationship between Pixels – Linear & Nonlinear operations.						
Unit:2	IMAGE ENHANCEMENT				12hours	
Image Enhancement in the spatial domain:- Background – some basic Gray level Transformations – Histogram Processing – Enhancement using Arithmetic / Logic operations – Basics of spatial filtering – Smoothing spatial filters – Sharpening spatial filters – Combining spatial enhancement methods.						

Unit:3	IMAGERESTORATION	12hours
Image Restoration: A model of the Image Degradation / Restoration Process – Noise models – Restoration is the process of noise only – Spatial Filtering – Periodic Noise reduction by frequency domain filtering – Linear, Portion – Invariant Degradations – Estimating the degradation function – Inverse filtering – Minimum mean square Error Filtering – Constrained least squares filtering – Geometric mean filter – Geometric Transformations.		
Unit:4	IMAGECOMPRESSION	11hours
ImageCompression:Fundamentals–Imagecompressionmodels–ElementsofInformation Theory – Error Free compression – Lossy compression – Image compression standards.		
Unit:5	IMAGESEGMENTATION	11hours
Image Segmentation: Detection and Discontinuities – Edge Linking and Boundary deduction – Thresholding – Region-Based segmentation – Segmentation by Morphological watersheds – The use of motion in segmentation.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
	TotalLecturehours	60hours
Text Books		
1	RafaelC.Gonzalez,RichardE.Woods,“DigitalImageProcessing”,SecondEdition,PHI/Pearson Education.	
2	B.Chanda,D.DuttaMajumder,“DigitalImageProcessingandAnalysis”,PHI, 2003.	
ReferenceBooks		
1	NickEfford,“DigitalImageProcessingapracticalintroducingusingJava”,Pearson Education, 2004.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://nptel.ac.in/courses/117/105/117105135/	
2	https://www.tutorialspoint.com/dip/index.htm	
3	https://www.javatpoint.com/digital-image-processing-tutorial	

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

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

III SEMESTER

Coursecode	23CSCC302	CLOUDCOMPUTING	L	T	P	C
Core/Elective/Supportive	Core-VIII		6			5
Pre-requisite	BasicsofCloud&itsApplications					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Gainknowledgeoncloudcomputing,cloudservices,architecturesandapplications. 2. Enablethestudentstolearnthebasicsofcloudcomputingwithrealtime usage 3. Howtostoreandshare,inandfromcloud? 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandtheconceptsofCloudanditsservices					K1,K2
2	CollaborateCloudforEvent&ProjectManagement					K3,K4
3	Analyzeon cloudin –WordProcessing,SpreadSheets,Mail,Calendar, Database					K4,K5
4	Analyzecloudinsocial networks					K5,K6
5	Explorecloudstorageandsharing					K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
INTRODUCTION Cloud Computing Introduction, From, Collaboration to cloud, Working of cloud computing, pros and cons, benefits, developing cloud computing services, Cloud service development, discovering cloud services.						
Unit:2	CLOUDCOMPUTING				12hours	
CLOUD COMPUTING FOR EVERYONE Centralizing email communications, cloudcomputing for community, collaborating on schedules, collaborating on group projects and events, cloud computing for corporation, mapping, schedules, managing projects, presenting on road.						
Unit:3	CLOUDSERVICES				12hours	
USING CLOUD SERVICES Collaborating on calendars, Schedules and task management, exploring on line scheduling and planning, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, spreadsheets, and databases.						

Unit:4	OUTSIDETHECLOUD	12hours
OUTSIDETHECLOUDEvaluatingwebmailservices,Evaluatinginstantmessaging, Evaluatingwebconferencetools,creatinggroupsonsocialnetworks,Evaluatingonline groupware,collaboratingviablogsandwikis.		
Unit:5	STORINGAND SHARING	10hours
STORING AND SHARING Understanding cloud storage, evaluating on line file storage, exploring on line book marking services, exploring on line photo editing applications, exploring photo sharing communities, controlling it with web based desktops.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		60hours
Text Books		
1	MichaelMiller,“Cloud Computing”,PearsonEducation,NewDelhi, 2009.	
ReferenceBooks		
1	Anthony T. Velte, “Cloud Computing: A Practical Approach”, 1st Edition, Tata McGrawHill Education Private Limited, 2009.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://nptel.ac.in/courses/106/105/106105167/	
2	https://www.tutorialspoint.com/cloud_computing/index.htm	
3	https://www.javatpoint.com/cloud-computing-tutorial	

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

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

III SEMESTER

Coursecode	23CSC303	NETWORKSECURITYAND CRYPTOGRAPHY	L	T	P	C
Core/Elective/Supportive	Core-IX		6			5
Pre-requisite	BasicsofNetworks&itsSecurity					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Enable students to learn the Introduction to Cryptography, Web Security and Case studies in Cryptography. 2. To gain knowledge on classical encryption techniques and concepts of modular arithmetic and number theory. 3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms. 4. To explore the design issues and working principles of various authentication Applications and various secure communication standards including Kerberos, IPsec, and SSL/TLS and email. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Understandtheprocessofthecryptographicalgorithms					K1,K2
2	Compareandapplydifferentencryptionanddecryptiontechniquesetosolveproblems related to confidentiality and authentication					K2,K3
3	Applyandanalyzeappropriatesecuritytechniquesetosolvenetworksecurity problem					K3,K4
4	Exploresuitablecryptographicalgorithms					K4,K5
5	Analyzedifferentdigitalsignaturealgorithmstoachieveauthenticationand design secure applications					K5,K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
Introduction to Cryptography – Security Attacks – Security Services –Security Algorithm- Stream cipher and Block cipher - Symmetric and Asymmetric-key Cryptosystem Symmetric Key Algorithms: Introduction – DES – Triple DES – AES – IDEA – Blowfish – RC5.						
Unit:2	CRYPTOSYSTEM				12hours	
Public-keyCryptosystem:IntroductiontoNumberTheory-RSAAlgorithm–KeyManagement -Diffie-HellmanKeyexchange–EllipticCurveCryptographyMessageAuthenticationand Hash functions – Hash and Mac Algorithm – Digital Signatures and Authentication Protocol.						

Unit:3	NETWORK SECURITY	12hours
NetworkSecurityPractice:AuthenticationApplications–Kerberos–X.509Authentication services and Encryption Techniques. E-mail Security – PGP – S / MIME – IP Security.		
Unit:4	WEB SECURITY	10hours
WebSecurity-SecureSocketLayer–SecureElectronicTransaction.SystemSecurity-Intruders and Viruses – Firewalls– Password Security.		
Unit:5	CASE STUDY	12hours
CaseStudy:ImplementationofCryptographicAlgorithms–RSA–DSA–ECC(C/JAVA Programming). Network Forensic – Security Audit - Other Security Mechanism: Introduction to: Stenography – Quantum Cryptography – Water Marking - DNA Cryptography		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars–webinars		
	TotalLecturehours	60hours
Text Books		
1	WilliamStallings,“CryptographyandNetworkSecurity”, PHI/PearsonEducation.	
2	BruceSchneir,“AppliedCryptography”,CRC Press.	
ReferenceBooks		
1	A.Menezes, P Van Oorschot and S.Vanstone, “Hand Book ofApplied Cryptography”, CRC Press, 1997	
2	AnkitFadia, ”NetworkSecurity”,MacMillan.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://nptel.ac.in/courses/106/105/106105031/	
2	http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html	
3	https://www.tutorialspoint.com/cryptography/index.htm	

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

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

III SEMESTER

Coursecode	23CSCC304	DATASCIENCE&ANALYTICS	L	T	P	C
Core/Elective/Supportive	Core-X		6			4
Pre-requisite	Basics of Data Science & its Applications					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Introduce the student to data science, big data & its ecosystem. 2. Learn data analytics & its life cycle. 3. To explore the programming language R, with respect to the data mining algorithms. 4. Relate the relationship between artificial intelligence, machine learning and data science. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concept of data science and its techniques				K1, K2	
2	Review data analytics				K2, K3	
3	Apply and determine appropriate Data Mining techniques using R to real time applications				K3, K4	
4	Analyze on clustering algorithms				K4, K5	
5	Analyze on regression methods in AI				K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5 -Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
Introduction of Data Science: data science and big data – facets of data- data science process- Ecosystem- The Data Science process – six steps- Machine Learning.						
Unit:2	BASICS OF DATA ANALYTICS				12hours	
Data Analytics life cycle- review of data analytics- Advanced data Analytics- technology and tools.						
Unit:3	DATA ANALYTICS USING R				12hours	
Basic Data Analytics using R : R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.						

Unit:4	CLUSTERING	12hours
Overview of Clustering : K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R –Classification – Decision Trees – Overview of a Decision Tree – DecisionTree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes’ Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.		
Unit:5	ARTIFICIALINTELLIGENCE	10hours
Artificialintelligence:MachineLearninganddeeplearningindatascience-Clustering, association rules. Linear regression-logistic regression-Additional regression methods.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		60hours
Text Books		
1	Introducing-Data-Science-Big-Data-Machine-Learning-and-more-using-Python-tools-2016.pdf	
2	Datascienceinbigdata analytics-Wiley2015JohnWiley&Sons	
ReferenceBooks		
1	AsimpleintroductiontoDataScience-LarsNielsen2015	
2	Introducing Data Science Davy Cielen, Arno D.B.Meysman, Mohamed Ali 2016 Manning Publication	
3	RProgrammingforData Science-RogerD.Peng 2015LeanPublication	
4	DataScience&BigDataAnalytics:Discovering,Analyzing,VisualizingandPresenting Data	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.tutorialspoint.com/python_data_science/index.htm	
2	https://www.javatpoint.com/data-science	
3	https://nptel.ac.in/courses/106/106/106106179/	

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

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

IV – SEMESTER

Coursecode	23CSCP401	PRACTICALII:PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive	Core-XI				6	5
Pre-requisite	BasicsofanyOOProgrammingLanguage					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Thiscoursepresentsanoverviewofelementarydataitems,lists,dictionaries,setsandtuples 2. TounderstandandwritesimplePythonprograms 3. ToUnderstandtheOOPSconceptsofPython 4. Todevelopweb applications usingPython 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	AbletowriteprogramsinPythonusingOOPSconcepts				K1,K2	
2	TounderstandtheconceptsofFileoperationsandModulesinPython				K2,K3	
3	Implementationoflists,dictionaries,setsandtuplesas programs				K3,K4	
4	Todevelopweb applications usingPython				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
LISTOF PROGRAMS					75hours	
ImplementthefollowinginPython:						
<ol style="list-style-type: none"> 1. Programsusingelementarydataitems,lists,dictionariesandtuples 2. Programsusingconditionalbranches, 3. Programsusingloops. 4. Programsusingfunctions 5. Programsusingexceptionhandling 6. Programsusinginheritance 7. Programsusingpolymorphism 8. Programstoimplementfileoperations. 9. Programsusingmodules. 10. Programsforcreatingdynamicandinteractivewebpagesusingforms. 						
TotalLecturehours					75hours	

Text Books	
1	BillLubanovic,“Introducing Python”,O’Reilly,FirstEdition-SecondRelease,2014.
2	MarkLutz,“LearningPython”, O’Reilly,FifthEdition, 2013.
ReferenceBooks	
1	David M. Beazley,“Python Essential Reference”, Developer’s Library, Fourth Edition,2009.
2	SheetalTaneja,Naveen Kumar, ”Python Programming-A Modular Approach”,PearsonPublications.
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://www.programiz.com/python-programming/
2	https://www.tutorialspoint.com/python/index.htm
3	https://onlinecourses.swayam2.ac.in/aic20_sp33/preview

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

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

IV SEMESTER

Coursecode	23CSCP402	PRACTICAL VII : WEB APPLICATION DEVELOPMENT AND HOSTING LAB	L	T	P	C
Core/Elective/Supportive		Core-XII			6	5
Pre-requisite		Basic Programming using HTML tags				
Course Objectives:						
The main objectives of this course are to:						
1. Able to design a webpage using HTML tags						
2. To enable the student to use Framesets, hyperlinks and different formatting features of HTML tags						
3. Enable the student to use Forms & other controls in a webpage						
4. To create interactive applications using PHP						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand & implement the basic HTML tags to create static webpages				K1, K2	
2	Capable of using hyperlinks, frames, images, tables, in a webpage				K2, K3	
3	Able to write dynamic web applications using HTML forms				K4, K5	
4	Must be able to write dynamic web applications in PHP & HTML tags using XAMPP.				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
LIST OF PROGRAMS						30 hours
<ol style="list-style-type: none"> 1. Develop a website for your college using advanced tags of HTML. 2. Write names of several countries in a paragraph and store it as an HTML document, world.html. Each country name must be a hot text. When you click India (for example), it must open india.html and it should provide a brief introduction about India. 3. Develop a HTML document to i) display Text with Bullets / Numbers - Using Lists ii) to display the Table Format Data 4. Develop a Complete Web Page using Frames and Framesets which gives the Information about a Hospital using HTML. 5. Write a HTML document to print your Bio-Data in a neat format using several components. 6. Develop a HTML document to display a Registration Form for an inter-collegiate function. 						

7. Using HTML form accept Customer details like Name, City, Pin code, Phone number and Email address and validate the data and display appropriate messages for violations using PHP (Eg. Name is Mandatory field; Pin code must be 6 digits, etc.). 8. Write a program to accept two numbers n1 and n2 using HTML form and display the Prime numbers between n1 and n2 using PHP.		
Total Lecture hours		30hours
Text Books		
1	Ivan Bayross, "Web Enabled Commercial Applications Development Using HTML, JavaScript, DHTML and PHP", BPB Publications, 4th Revised Edition, 2010.	
Reference Books		
2	A.K. Saini and Sumint Tuli, "Mastering XML", First Edition, New Delhi, 2002.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.tutorialspoint.com/xml/index.htm	
2	https://www.tutorialspoint.com/internet_technologies/websites_development.htm	
3	https://www.youtube.com/watch?v=PlxWf493en4	

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

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

**ELECTIVE COURSES
I – SEMESTER**

Coursecode	23CSCE104	ADVANCEDSOFTWARE ENGINEERING	L	T	P	C
Core/Elective/Supportive	Elective-I		5			3
Pre-requisite	BasicsofSoftwareEngineering&SPM					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Introduce to Software Engineering, Design, Testing and Maintenance. 2. Enable the student to learn the concepts of Software Engineering. 3. Learn about Software Project Management, Software Design & Testing. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand about Software Engineering process				K1, K2	
2	Understand about Software project management skills, design and quality management				K2, K3	
3	Analyze on Software Requirements and Specification				K3, K4	
4	Analyze on Software Testing, Maintenance and Software Re-Engineering				K4, K5	
5	Design and conduct various types and levels of software quality for a software project				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				15hours	
Introduction: The Problem Domain – Software Engineering Challenges - Software Engineering Approach – Software Processes: Software Process – Characteristics of a Software Process – Software Development Process Models – Other software processes.						
Unit:2	SOFTWARE REQUIREMENTS				15hours	
Software Requirements Analysis and Specification : Requirement engineering – Type of Requirements – Feasibility Studies – Requirements Elicitation – Requirement Analysis – Requirement Documentation – Requirement Validation – Requirement Management – SRS - Formal System Specification – Axiomatic Specification – Algebraic Specification - Case study: Student Result management system. Software Quality Management – Software Quality, Software Quality Management System, ISO 9000, SEI CMM.						
Unit:3	PROJECT MANAGEMENT				15hours	
Software Project Management: Responsibilities of a software project manager – Project planning – Metrics for Project size estimation – Project Estimation Techniques – Empirical Estimation Techniques – COCOMO – Halstead’s software science – Staffing level estimation – Scheduling– Organization and Team Structures – Staffing – Risk management – Software Configuration Management – Miscellaneous Plan.						

Unit:4	SOFTWAREDESIGN	15hours
Software Design: Outcome of a Design process – Characteristics of a good software design – Cohesion and coupling - Strategy of Design – Function Oriented Design – Object Oriented Design - Detailed Design - IEEE Recommended Practice for Software Design Descriptions.		
Unit:5	SOFTWARETESTING	13hours
Software Testing: A Strategic approach to software testing – Terminologies – Functional testing– Structural testing – Levels of testing – Validation testing - Regression testing – Art of Debugging–Testingtools-Metrics-ReliabilityEstimation.SoftwareMaintenance -Maintenance Process - Reverse Engineering – Software Re-engineering - Configuration Management Activities.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
TotalLecturehours		75hours

Text Books

1	AnIntegratedApproachtoSoftwareEngineering–PankajJalote,NarosaPublishingHouse, Delhi, 3rd Edition.
2	FundamentalsofSoftwareEngineering –RajibMall,PHIPublication,3rdEdition.

ReferenceBooks

1	SoftwareEngineering–K.K.AggarwalandYogeshSingh,NewAgeInternational Publishers, 3 rd edition.
2	APractitionersApproach-SoftwareEngineering, -R.S.Pressman,McGraw Hill.
3	Fundamentals of Software Engineering - Carlo Ghezzi, M. Jarayeri, D. Manodrioli,PHIPublication.

RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]

1	https://www.javatpoint.com/software-engineering-tutorial
2	https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3	https://onlinecourses.nptel.ac.in/noc19_cs69/preview

MappingwithProgrammingOutcomes

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

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

Coursecode	23CSCE104	MULTIMEDIAANDITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive	Elective-I		4			3
Pre-requisite	BasicsofMultimedia					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. TointroducethestudentstheconceptsofMultimedia,Images&Animation. 2. TointroduceMultimediaauthoring tools 3. TounderstandtheroleofMultimediainInternet 4. ToknowaboutHighDefinitionTelevisionandDesktopComputing–Knowledgebased Multimedia systems 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandthebasicconceptsofMultimedia					K1,K2
2	DemonstrateMultimediaauthoringtools					K2,K3
3	AnalyzeconceptsofSound,Images,Video&Animation					K4
4	ApplyandAnalyzeetheroleofMultimediainInternetandrealtimeapplications					K4,K5
5	AnalyzeMultimediaapplicationsusingHDTV					K5,K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
WhatisMultimedia?–IntroductiontomakingMultimedia–MacintoshandWindows Production platforms – Basic Software tools.						
Unit:2	MULTIMEDIA TOOLS				12hours	
MakingInstantMultimedia–Multimediaauthoringtools–Multimediabuildingblocks–Text– Sound.						
Unit:3	ANIMATION				10hours	
Images–Animation–Video.						
Unit:4	INTERNET				12hours	
MultimediaandtheInternet–TheInternetandhowitworks–ToolsforWorldWideWeb– Designing for the World Wide Web.						
Unit:5	MULTIMEDIASYSTEMS				12hours	
HighDefinitionTelevisionandDesktopComputing –Knowledgebased Multimedia systems.						

Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars - webinars		
TotalLecturehours		60hours
Text Books		
1	TayVaughan, “Multimediamakingitwork”,FifthEdition,TataMcGrawHill.	
2	JohnF.KoegelBufford,“MultimediaSystems”,Pearson Education.	
ReferenceBooks		
1	JudithJeffloate,“MultimediainPractice(TechnologyandApplications)”,PHI,2003.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.tutorialspoint.com/multimedia/index.htm	
2	https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_multimedia.htm	
3	https://nptel.ac.in/courses/117/105/117105083/	

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

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

I – SEMESTER

Coursecode	23CSCE105	PRACTICAL I: ALGORITHM AND OOPS LAB	L	T	P	C
Core/Elective/Supportive		Elective-II			5	3
Pre-requisite	Basic Programming of C++ language					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. This course covers the basic data structures like Stack, Queue, Tree, List. 2. This course enables the student to learn the application of the data structures using various techniques 3. It also enables the student to understand C++ language with respect to OOAD concepts 4. Application of OOPS concepts. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of object-oriented with respect to C++				K1, K2	
2	Able to understand and implement OOPS concepts				K3, K4	
3	Implementation of data structures like Stack, Queue, Tree, List using C++				K4, K5	
4	Application of the data structures for Sorting, Searching using different techniques.				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
LIST OF PROGRAMS					75 hours	
<ol style="list-style-type: none"> 1) Write a program to solve the tower of Hanoi using recursion. 2) Write a program to traverse through binary search tree using traversals. 3) Write a program to perform various operations on stack using linked list. 4) Write a program to perform various operations in circular queue. 5) Write a program to sort an array of elements using quick sort. 6) Write a program to solve number of elements in ascending order using heap sort. 7) Write a program to solve the knapsack problem using greedy method 8) Write a program to search for an element in a tree using divide & conquer strategy. 9) Write a program to place the 8 queens on an 8X8 matrix so that no two queens Attack. 10) Write a C++ program to perform Virtual Function 11) Write a C++ program to perform Parameterized constructor 12) Write a C++ program to perform Friend Function 13) Write a C++ program to perform Function Overloading 14) Write a C++ program to perform Single Inheritance 15) Write a C++ program to perform Employee Details using files. 						

Expertlectures,onlineseminars –webinars	
TotalLecturehours	
75hours	
Text Books	
1	Goodrich,“DataStructures&AlgorithmsinJava”,Wiley3rd edition.
2	Skiena, ”TheAlgorithmDesignManual”, SecondEdition, Springer, 2008
ReferenceBooks	
1	AnanyLevith, ”IntroductiontotheDesignandAnalysisof algorithm”, Pearson Education Asia, 2003.
2	RobertSedgewick, PhillipeFlajolet, ”AnIntroductiontotheAnalysisofAlgorithms”, Addison-Wesley Publishing Company, 1996.
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://onlinecourses.nptel.ac.in/noc19_cs48/preview
2	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs19/
3	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_analysis.htm

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

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

Coursecode	23CSCE105	Cyber Security Lab			L	T	P	C
Core/Elective/Supportive	Elective-II					5	3	
Pre-requisite	Basic Programming of C++ language							
Course Objectives:								
<ol style="list-style-type: none"> 1. To learn and implement to Change the wireless device mode as monitor mode 2. To develop in multiple vulnerabilities webserver 3. To understand and implement the open ports in the network 4. To acquire programming skills in Implement various wireless device modes 5. To comprehend related to find the sub domains of webpage 								
Expected Course Outcomes:								
On the successful completion of the course, student will be able to:								
1	Understand the concepts of object oriented with respect to C++						K1, K2	
2	Able to understand and implement OOPS concepts						K3, K4	
3	Implementation of data structures like Stack, Queue, Tree, List using C++						K4, K5	
4	Application of the data structures for Sorting, Searching using different techniques.						K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create								
LIST OF PROGRAMS							75 hours	
<ol style="list-style-type: none"> 1. Install virtual box (kali Linux) 2. Generate a secure password using keepass 3. Change the wireless device mode as monitor mode 4. Find the known and open vulnerabilities of system using metasploit 5. Identify the multiple vulnerabilities webserver using nikto tool 6. Identify the open ports in the network using nmap tools 7. List all the network around us and display the information about the networks 8. Sniff and capture the packet sent over HTTP requests 9. Find the owners of internet resources using Whois Lookup tool 10. Find the subdomains of webpage using knock tool 								
Expert lectures, online seminars –webinars								

Mapping Course outcomes with Programme outcomes

CO s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	S	-	-	-	-	L	-	-	-	-	-	-
CO 2	S	-	M	-	M	L	-	-	-	-	-	-
CO 3	S	-	S	-	S	L	-	-	-	S	S	S
CO 4	S	-	S	-	S	L	-	-	-	S	S	S
CO 5	S	-	S	-	S	L	-	-	-	S	S	S

S- Strong; M-Medium; L-Low

II – SEMESTER

Coursecode	23CSCE204	ARTIFICIALINTELLIGENCE& MACHINE LEARNING	L	T	P	C
Core/Elective/Supportive		Elective-III	4			3
Pre-requisite		Basics of AI & an Introduction about ML				
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Enable the student to learn the basic functions of AI, Heuristic Search Techniques. 2. Provide knowledge on concepts of Representations and Mappings and Predicate Logic. 3. Introduce Machine Learning with respect Data Mining, Big Data and Cloud. 4. Study about Applications & Impact of ML. 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Demonstrate AI problems and techniques					K1, K2
2	Understand machine learning concepts					K2, K3
3	Apply basic principles of AI in solution that require problem solving, inference, perception, knowledge representation, and learning					K3, K4
4	Analyze the impact of machine learning on applications					K4, K5
5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system					K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION					12hours
Introduction: AI Problems - AI techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems - Problem Characteristics - Issues in design of Search.						
Unit:2	SEARCH TECHNIQUES					12hours
Heuristic Search techniques: Generate and Test - Hill Climbing- Best-First, Problem Reduction, Constraint Satisfaction, Means-end analysis. Knowledge representation issues: Representations and mappings - Approaches to Knowledge representations - Issues in Knowledge representations - Frame Problem.						
Unit:3	PREDICATE LOGIC					12hours
Using Predicate logic: Representing simple facts in logic - Representing Instance and Isa relationships - Computable functions and predicates - Resolution - Natural deduction. Representing knowledge using rules: Procedural Vs Declarative knowledge- Logic programming - Forward Vs Backward reasoning - Matching- Control knowledge.						

Unit:4	MACHINE LEARNING	12hours
Understanding Machine Learning: What Is Machine Learning? - Defining Big Data - Big Data in Context with Machine Learning - The Importance of the Hybrid Cloud - Leveraging the Power of Machine Learning - The Roles of Statistics and Data Mining with Machine Learning - Putting Machine Learning in Context - Approaches to Machine Learning.		
Unit:5	APPLICATIONS OF MACHINE LEARNING	10hours
Looking Inside Machine Learning: The Impact of Machine Learning on Applications - Data Preparation - The Machine Learning Cycle.		
Unit:6	Contemporary Issues	2 hours
Expert lectures, online seminars – webinars		
Total Lecture hours		60hours
Text Books		
1	Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.	
2	George FLuger, "Artificial Intelligence", 4th Edition, Pearson Education Publ, 2002.	
Reference Books		
1	Machine Learning For Dummies®, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.ibm.com/downloads/cas/GB8ZMQZ3	
2	https://www.javatpoint.com/artificial-intelligence-tutorial	
3	https://nptel.ac.in/courses/106/105/106105077/	

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

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

Coursecode	23CSCE204	CRITICAL THINKING, DESIGN THINKING AND PROBLEMSOLVING	L	T	P	C
Core/Elective/Supportive	Elective-VI		4			3
Pre-requisite	BasicsofLogical&ReasoningSkills					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Learncriticalthinkinganditsrelatedconcepts 2. Learndesignthinkinganditsrelatedconcepts 3. DevelopThinkingpatterns,Problemsolving&Reasoning 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandtheconceptsofCriticalthinkinganditsrelatedtechnology				K1,K2	
2	Focusontheexplicitdevelopmentofcriticalthinkingandproblemsolving skills				K2,K3	
3	Applydesignthinkinginproblems				K3,K4	
4	Makeadecisionandtakeactionsbasedonanalysis				K4,K5	
5	Analyze the concepts of Thinking patterns, Problem solving & Reasoning inreal time applications				K5,K6	
K1-Remember;K2-Understand;K3-Apply; K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	CRITICALTHINKING				12hours	
Critical Thinking: Definition, Conclusions and Decisions, Beliefs and Claims, Evidence –finding, evaluation, Inferences, Facts – opinion, probable truth, probably false, Venn diagram. Applied critical thinking: Inference, Explanation, Evidence, Credibility, Two Case Studies, critical thinking and science, critical evaluation, self assessment.						
Unit:2	DESIGNTHINKING				12hours	
Design Thinking: Introduction, Need of Design Thinking, problem to question - design thinking process, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, problem exploration, Stake holder assessment, design thinking for manufacturers, smart Idea to implementation.						
Unit:3	CASESTUDY				12hours	
Thinking to confidence, fear management, duty Vs passion, Team management, Tools for Thinking, prototype design, Relevance of Design and Design Thinking in engineering, human centered design, case study: apply design thinking in problem.						
Unit:4	PROBLEMSOLVING				10hours	
Problem solving: problem definition, problem solving methods, selectingand using information, dataprocessing,solutionmethods,solvingproblemsbysearching,recognizingpatterns,spatial						

reasoning,necessityandsufficiency, choosingandusingmodels,makingchoicesanddecisions.										
Unit:5		REASONING							12hours	
Reasoning: Deductive and hypothetical reasoning, computational problem solving; generating, implementing, and evaluating solutions, interpersonal problem solving. Advanced problem solving: Combining skills – using imagination, developing models, Carrying out investigations, Data analysis and inference. Graphical methods of solution, Probability, tree diagrams and decision trees										
Unit:6		ContemporaryIssues							2 hours	
Expertlectures,onlineseminars –webinars										
								TotalLecturehours		60hours
Text Books										
1	JohnButterworthandGeoffThwaites,Thinkingskills:CriticalThinkingandProblem Solving, Cambridge University Press, 2013.									
2	H.S.FoglerandS.E.LeBlanc,StrategiesforCreativeProblemSolving,2ndedition, Pearson, Upper Saddle River, NJ, 2008.									
ReferenceBooks										
1	A. Whimbey and J. Lochhead, Problem Solving & Comprehension, 6th edition, Lawrence Erlbaum, Mahwah, NJ, 1999.									
2	M. Levine, Effective Problem Solving, 2nd edition, Prentice Hall, Upper Saddle River, NJ, 1994.									
3	MichaelBaker,TheBasicofCriticalThinking,TheCriticalThinkingCopress, 2015.									
4	DavidKelleyandTomKelley,CreativeConfidence,2013.									
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]										
1	https://www.tutorialspoint.com/critical_thinking/index.htm									
2	https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm									
3	https://nptel.ac.in/courses/109/104/109104109/									
MappingwithProgrammingOutcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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

II - SEMESTER

Coursecode	23CSCE205	INTERNETOF THINGS	L	T	P	C
Core/Elective/Supportive		Elective-IV	4			3
Pre-requisite		BasicsofSensors&itsApplications				
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. AboutInternetofThingswherevariouscommunicatingentitiesarecontrolledandmanaged for decision making in the application domain. 2. EnablestudentstolearntheArchitectureofIoTandIoTTechnologies 3. DevelopingIoTApplicationsandSecurityinIoT,BasicElectronicsforIoT,ArduinoIDE, Sensors and Actuators Programming NODEMCU using Arduino IDE. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	UnderstandaboutIoT,itsArchitectureandits Applications					K1,K2
2	UnderstandbasicelectronicsusedinIoT&itsrole					K2,K3
3	DevelopapplicationswithCusingArduinoIDE					K4
4	Analyzeaboutsensorsandactuators					K5,K6
5	DesignIoTinrealtimeapplicationsusingtoday'sinternet&wirelesstechnologies					K6
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION					12hours
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT– Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT						
Unit:2	BASICELECTRONICSFORIoT					12hours
Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – BinaryCalculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.						
Unit:3	PROGRAMMINGUSINGARDUINO					12hours
Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.						

Unit:4	SENSORSANDACTUATORS	10hours
SensorsandActuators:AnalogandDigitalSensors–Interfacingtemperaturesensor,ultrasound sensorandinfrared(IR)sensorwithArduino– Interfacing LEDandBuzzerwithArduino.		
Unit:5	SENSORDATAININTERNET	12hours
Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak).		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
	TotalLecturehours	hours
Text Books		
1	ArshdeepBahga,VijayMadiseti,“InternetofThings:AHands-OnApproach”,2014. ISBN: 978-0996025515	
2	Boris Adryan, Dominik Obermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.	
ReferenceBooks		
1	MichaelMargolis,“ArduinoCookbook”,O’Reilly,2011	
2	MarcoSchwartz, “InternetofThingswithESP8266”,PacktPublishing, 2016.	
3	DhivyaBala,“ESP8266:StepbyStepTutorialforESP8266IoT,ArduinoNODEMCU Dev. Kit”, 2018.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://onlinecourses.nptel.ac.in/noc20_cs66/preview	
2	https://www.javatpoint.com/iot-internet-of-things	
3	https://www.tutorialspoint.com/internet_of_things/index.htm	

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

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

Coursecode	23CSCE205	MOBILECOMPUTING	L	T	P	C
Core/Elective/Supportive	Elective-IV		4			3
Pre-requisite	BasicsofMobile Communication					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. PresenttheoverviewofMobilecomputing,Applicationsand Architectures. 2. Describethefuturisticcomputingchallenges. 3. Enablethestudentstolearntheconceptofmobilecomputing. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Understandtheneedandrequirementsofmobilecommunication				K1,K2	
2	Focusonmobilecomputingapplicationsandtechniques				K2,K3	
3	Demonstratesatellitecommunicationinmobile computing				K4	
4	Analyzeaboutwirelesslocalloop architecture				K5,K6	
5	Analyzevariousmobilecommunicationtechnologies				K6	
K1-Remember;K2-Understand;K3-Apply; K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
Introduction: Advantages of Digital Information - Introduction to Telephone Systems –Mobile communication: Need for Mobile Communication – Requirements of Mobile Communication – History of Mobile Communication.						
Unit:2	MOBILECOMMUNICATION				12hours	
Introduction to Cellular Mobile Communication – Mobile Communication Standards –Mobility Management – Frequency Management – Cordless Mobile Communication Systems.						
Unit:3	MOBILECOMPUTING				12hours	
Mobile Computing: History of data networks – Classification of Mobile data networks - CDPD System – Satellites in Mobile Communication: Satellite classification – Global Satellite Communication – Changeover from one satellite to other – Global Mobile Communication – Interferences in Cellular Mobile Communication.						
Unit:4	MOBILECOMMUNICATIONSYSTEM				11hours	
Important Parameters of Mobile Communication System – Mobile Internet: Working of Mobile IP – Wireless Network Security – Wireless Local Loop Architecture: Components in WLL – Problems in WLL – Modern Wireless Local Loop – Local Multipoint Distribution Service – Wireless Application Protocol.						
Unit:5	COMMUNICATIONTECHNOLOGY				11hours	

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

Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars–webinars		
TotalLecturehours		60hours
Text Books		
1	T.G.Palanivelu,R.Nakkeeran,“WirelessandMobileCommunication”,PHILimited, 2009.	
2	JochenSchiller,“MobileCommunications”,SecondEdition,PearsonEducation, 2007.	
ReferenceBooks		
1	AsokeKTalukder,HasanAhmed,RoopaYavagal,“MobileComputing”,TMH,2010.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitetc.]		
1	https://www.tutorialspoint.com/mobile_computing/index.htm	
2	https://www.javatpoint.com/mobile-computing	
3	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/	

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

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

III SEMESTER

Coursecode	23CSCE305	PRACTICALV: DIGITAL IMAGE PROCESSING Using MATLAB	L	T	P	C
Core/Elective/Supportive		Elective-V			3	3
Pre-requisite		Basic Programming of Image Processing & an intro to MATLAB				
Course Objectives:						
The main objectives of this course are to:						
1. To understand the basics of Digital Image Processing fundamentals, image enhancement and image restoration techniques						
2. To enable the student to learn the fundamentals of image compression and segmentation						
3. To understand Image Restoration & Filtering Techniques						
4. Implementation of the above using MATLAB						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To write programs in MATLAB for image processing using the techniques				K1, K2	
2	To be able to implement Image Enhancements & Restoration techniques				K2, K3	
3	Capable of using Compression techniques in an Image				K3, K4	
4	Must be able to manipulate the image and Segment it				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
LIST OF PROGRAMS					60 hours	
1. Implement Image enhancement Technique.						
2. Histogram Equalization						
3. Image Restoration.						
4. Implement Image Filtering.						
5. Edge detection using Operators (Roberts, Prewitts and Sobel operators)						
6. Implement image compression.						
7. Image Subtraction						
8. Boundary Extraction using morphology.						
9. Image Segmentation						
Total Lecture hours					60 hours	

Text Books	
1	RafaelC.Gonzalez,RichardE.Woods,“DigitalImageProcessing”,Second Edition, PHI/PearsonEducation.
2	B.Chanda,D.DuttaMajumder,“DigitalImageProcessingandAnalysis”,PHI, 2003.
ReferenceBooks	
1	NickEfford,“DigitalImageProcessingapacticalintroducingusingJava”,Pearson Education, 2004.
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://nptel.ac.in/courses/117/105/117105135/
2	https://www.tutorialspoint.com/dip/index.htm
3	https://www.javatpoint.com/digital-image-processing-tutorial

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

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

Coursecode	23CSCE305	BLOCKCHAIN TECHNOLOGY LAB	L	T	P	C
Core/Elective/Supportive	Elective-V			4		3
Pre-requisite	BasicsofBlockChain&CryptoCurrency					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. Understandthefundamentalsofblockchainandcryptocurrency. 2. Understandtheinfluenceandroleofblockchaininvariousother fields. 3. Learnsecurityfeaturesandits significance. 5. Identifyproblems&challengesposedbyBlockChain. 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Demonstrateblockchaintechnologyandcryptocurrency				K1,K2	
2	Understandtheminingmechanisminblockchain				K2	
3	Applyandidentifysecuritymeasures,andvarioustypesofserviceshatallow people to trade and transact with bitcoins				K3,K4	
4	ApplyandanalyzeBlockchaininhealthcareindustry				K4,K5	
5	Analyzesecurity,privacy,andefficiencyofagivenBlockchainsystem				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
LISTOF PROGRAMS						60hours
<ol style="list-style-type: none"> 1. Create a Public Ledger and Private Ledger with the various attributes like Access, Network Actors, Native token, Security, Speed and examples. 2. Building and Deploying MultiChain private Blockchain 3. Write Hello World smart contract in a higher programming language (Solidity) 4. Construct the Naïve block chain 5. Construct and deploy your contract (Use deploy method) 6. Set up a Regtest environment 7. Build a payment request URI 8. Hashcash implementation 9. Develop a toy application using Blockchain 10. Create simple wallet transaction from one account to another account using Metamask. 						
TotalLecturehours						60hours

Text Books										
1	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (July 19, 2016).									
2	Antonopoulos, "MasteringBitcoin:UnlockingDigitalCryptocurrencies"									
ReferenceBooks										
1	SatoshiNakamoto, "Bitcoin: APeer-to-PeerElectronicCashSystem"									
2	RodrigodaRosaRighi, AntonioMarcosAlberti, MadhusudanSingh, "Blockchain Technology for Industry 4.0" Springer 2020.									
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]										
1	https://www.javatpoint.com/blockchain-tutorial									
2	https://www.tutorialspoint.com/blockchain/index.htm									
3	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs01/									
MappingwithProgrammingOutcomes										
Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

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

IV - SEMESTER

Coursecode	23CSCE404	WEB SERVICES	L	T	P	C
Core/Elective/Supportive		Elective-VI	4			2
Pre-requisite	Basics of Distributed Computing					
Course Objectives:						
The main objectives of this course are to:						
<ol style="list-style-type: none"> 1. Present the Web Services , Building real world Enterprise applications using Web Services with Technologies XML, SOAP , WSDL , UDDI 2. Get overview of Distributed Computing, XML, and its technologies 3. Update with QoS and its features 4. Develop Standards and future of Web Services 						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand web services and its related technologies					K1, K2
2	Understand XML concepts					K2, K3
3	Analyze on SOAP and UDDI model					K4, K5
4	Demonstrate the roadmap for the standards and future of web services					K5
5	Analyze QoS enabled applications in web services					K5, K6
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION					12hours
Introduction to web services – Overview of Distributed Computing- Evolution and importance of web services-Industry standards, Technologies and concepts underlying web services-Web services and enterprises-web services standards organization-web services platforms.						
Unit:2	XML FUNDAMENTALS					12hours
XML Fundamentals – XML documents-XML Namespaces-XML Schema – Processing XML.						
Unit:3	SOAP MODEL					12hours
SOAP: The SOAP model- SOAP messages-SOAP encoding- WSDL: WSDL structure- interface definitions-bindings-services-Using SOAP and WSDL-UDDI: About UDDI- UDDI registry Specification- Core data structures-Accessing UDDI						
Unit:4	TECHNOLOGIES AND STANDARDS					12hours
Advanced web services technologies and standards: Conversations overview-web services conversation language-WSCL interface components. Workflow: business process management-workflows and workflow management systems Security: Basics-data handling and forwarding-data storage-errors-Web services security issues.						

Unit:5	QUALITYOFSERVICE	10hours
Quality of Service: Importance of QoS for web services-QoS metrics-holes-design patterns-QoS enabled web services-QoS enabled applications. Web services management-web services standards and future trends.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
	TotalLecturehours	60hours
Text Books		
1	Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services: An Architects Guide”, Prentice Hall, Nov 2003.	
2	Keith Ballinger, “NET Web services: Architecture and Implementation with .Net”, Pearson Education, First Edition, Feb 2003.	
ReferenceBooks		
1	RameshNagappan,“DevelopingJavaWebServices:Architectinganddevelopingsecure Web Services Using Java”, John Wiley and Sons, first Edition Feb 2003.	
2	EricAMarksandMarkJWerrell,“ExecutiveGuidetoWebservices”,JohnWileyand sons, March 2003.	
3	AnneThomasManes,“WebServices:AmanagersGuide”,AddisonWesley,June2003.	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.tutorialspoint.com/webservices/index.htm	
2	https://www.javatpoint.com/web-services-tutorial	
3	https://www.btechguru.com/training--programming--xml--web-services--web-services-part-1-video-lecture--11801--24--147.html	

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

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

Coursecode	23CSCE404	ROBOTICPROCESSAUTOMATION FOR BUSINESS	L	T	P	C
Core/Elective/Supportive	Elective-VI		4			2
Pre-requisite	BasicsofRobots&itsApplications					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. LearntheconceptsofRPA,itsbenefits,typesandmodels. 2. GaintheknowledgeinapplicationofRPAinBusinessScenarios. 3. IdentifymeasuresandskillsrequiredforRPA 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	Demonstratethebenefits andethicsofRPA				K1,K2	
2	UnderstandtheAutomationcycleandits techniques				K2	
3	DrawinferencesandinformationprocessingofRPA				K3,K4	
4	Implement&ApplyRPAinBusinessScenarios				K5	
5	AnalyzeonRobots&leveragingautomation				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
Unit:1	INTRODUCTION				12hours	
IntroductiontoRPA -OverviewofRPA -BenefitsofRPAinabusinessenvironment -Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementingRPA -CentreofExcellence –Typesandtheirapplications -BuildinganRPAteam -ApproachforimplementingRPAinitiatives.						
Unit:2	AUTOMATION				12hours	
RoleofaBusinessManagerinAutomationinitiatives-SkillsrequiredbyaBusinessManagerfor successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people.						
Unit:3	AUTOMATIONIMPLEMENTATION				12hours	
Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows.						

Unit:4	ROBOT	12hours
Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.		
Unit:5	ROBOTSKILL	10hours
Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.		
Unit:6	ContemporaryIssues	2 hours
Expertlectures,onlineseminars –webinars		
	TotalLecturehours	60hours
Text Books		
1	Alok Mani Tripathi” Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool” Packt Publishing Limited March 2018.	
2	TomTaulli“TheRoboticProcessAutomationHandbook”Apress,February2020.	
ReferenceBooks		
1	SteveKaelble”RoboticProcessAutomation”JohnWiley&Sons,Ltd., 2018	
RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]		
1	https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_introduction.htm	
2	https://www.javatpoint.com/rpa	
3	https://onlinecourses.nptel.ac.in/noc19_me74/preview	
CourseDesigned By:		

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

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

SKILL ENHANCEMENT COURSES

II – SEMESTER

Coursecode	23CSCS206	DATAMINING USING R	L	T	P	C
Core/Elective/Supportive		SEC-I			4	2
Pre-requisite	BasicsofDMAgorithms&RProgramming					
CourseObjectives:						
Themainobjectivesofthiscourseareto:						
<ol style="list-style-type: none"> 1. ToenablethestudentstolearntheconceptsofDataMiningalgorithmsnamelyclassification, clustering, regression.... 2. Tounderstand&writeprogramsusingtheDMAgorithms 3. Toapplystatisticalinterpretationsforthesolutions 4. Abletousevisualizationstechniquesfor interpretations 						
ExpectedCourseOutcomes:						
Onthesuccessfulcompletionofthecourse,studentwillbeableto:						
1	AbletowriteprogramsusingRforAssociationrules,Clusteringtechniques				K1,K2	
2	Toimplementdataminingtechniqueslikeclassification, prediction				K2,K3	
3	AbletousedifferentvisualizationstechniquesusingR				K4,K5	
4	Toapplydifferentdataminingalgorithmsstosolvearealworldapplications				K5,K6	
K1-Remember;K2-Understand;K3-Apply;K4-Analyze;K5-Evaluate; K6-Create						
LISTOF PROGRAMS					75hours	
<ol style="list-style-type: none"> 1. ImplementApriorialgorithmtoextractassociationruleofdatamining. 2. Implementk-meansclusteringtechnique. 3. ImplementanyoneHierarchalClustering. 4. ImplementClassificationalgorithm. 5. ImplementDecisionTree. 6. LinearRegression. 7. DataVisualization. 						
TotalLecturehours					75hours	
Text Books						
1	MargaretH.Dunham,“DataMining:IntroductoryandAdvancedTopics”,Pearson education,2003.					
2	C.S.R. Prabhu, “Data Warehousing Concepts, Techniques, Productsand Applications”, PHI, Second Edition					
ReferenceBooks						
1	ArunK.Pujari,“DataMiningTechniques”,UniversitiesPress(India)Pvt. Ltd.,2003.					
2	AlexBerson,StephenJ.Smith,“DataWarehousing,DataMiningandOLAP”,TMCH, 2001.					

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.javatpoint.com/data-warehouse
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-warehousing-and-olap-2-video-lecture--12054--26--151.html

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

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

II SEMESTER

23CSCS206	SEC-I: SOCIAL NETWORKING LAB	C 2 P 4
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COURSE OBJECTIVES

- To familiarize the tools required to manage social network applications
- To analyze social networks like Facebook, LinkedIn, Google+, GitHub
- To teach the fundamental techniques and principles in achieving social networking environment.
- To enable students to have skills that will help them to solve real time applications.
- To get explore in the Github API.

LIST OF PROGRAMS

1. Creating and Exploring Twitter's API
2. To analyzing and visualizing tweets and tweet entities with frequency analysis
3. Creating and Exploring Facebook's Social Graph API
4. To analyzing the Facebook's Social Graph connections
5. Creating and Exploring LinkedIn API
6. To downloading LinkedIn connections as a CSV file
7. Creating and Exploring Google+ API
8. To create and querying Human Language Data with TF-IDF
9. Creating and Exploring GitHub's API
10. To analyzing GitHub interest graph

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1:	To understand , implement and review the fundamental techniques and principles for social networks.	K1-K6
CO2:	To design and develop the programs using the tools required to develop and manage social network like Facebook, LinkedIn, Google+, GitHub	K1-K6
CO3:	To create and explore the functionality of social networking tools such as GitHub	K1-K6
CO4	To understand , implement and review the fundamental principles for social network graph.	K1-K6
CO5	To comprehend and critically analyse the existing API for social networks	K1-K6

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

Mapping with ProgrammeOutcomes :

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

S- Strong; M-Medium; L-Low

III SEMESTER

Coursecode	23CSCS306	CLOUD COMPUTING LAB	L	T	P	C
Core/Elective/Supportive		SEC-II			3	2
Pre-requisite		Basic Programming using Cloud				
Course Objectives:						
The main objectives of this course are to:						
1. This course covers the basic data structures like Stack, Queue, Tree, List.						
2. This course enables the student to learn the applications of the data structures using various techniques						
3. It also enables the students to understand C++ language with respect to OOAD concepts						
4. Application of OOPS concepts						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the concepts of object oriented with respect to C++				K1, K2	
2	Able to understand and implement OOPS concepts				K3, K4	
3	Implementation of data structures like Stack, Queue, Tree, List using C++				K4, K5	
4	Application of the data structures for Sorting, Searching using different techniques.				K5, K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						
LIST OF PROGRAMS					60 hours	
1. Working with Google Drive to make spreadsheet and notes.						
2. Launch a Linux Virtual Machine.						
3. To host a static website						
4. Exploring Google cloud for the following a) Storage b) Sharing of data c) manage your calendar, to-do lists, d) a document editing tool						
5. Working and installation of Google App Engine						
6. Working and installation of Microsoft Azure						
7. To Connect Amazon Redshift with S3 bucket						
8. To Create and Query a No SQL Table						
Expert Lectures, online seminars–webinars						
Total Lecture hours					60 hours	
Text Books						
1	Michael Miller, "Cloud Computing", Pearson Education, New Delhi, 2009.					
Reference Books						
1	Anthony T. Velte, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGrawHill Education Private Limited, 2009.					

RelatedOnlineContents[MOOC,SWAYAM,NPTEL,Websitesetc.]	
1	https://nptel.ac.in/courses/106/105/106105167/
2	https://www.tutorialspoint.com/cloud_computing/index.htm
3	https://www.javatpoint.com/cloud-computing-tutorial

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

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

III SEMESTER

23CSCS306	SEC-II: DOT NET TECHNOLOGIES LAB	C 2 P 3
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COURSE OBJECTIVES:

- To get strong understanding of .NET Framework and C# programming.
- To get advanced programming skills in C# .NET OOPs Concepts
- To get advanced methods of manipulating data using Microsoft SQL Server.
- To get clear idea of how to developing real-time standalone, web applications using ASP .NET.
- To get clear understanding and get experience in Microsoft Azure.

LIST OF PROGRAMS:

Implement the following problems using C# with Visual Studio.

1. Demonstrate method overloading and method overriding
2. Class and Objects
3. Multilevel Inheritance
4. Interfaces
5. Demonstrate multiple type of Exceptions
6. Azure Storage Container Using the Microsoft Azure Storage Client Library
7. Demonstrate Read and Write a Data using Random Access Files
8. Employee management database using LINQ
9. Student management system using ASP.NET
10. Demonstrates simple Universal App.

COURSE OUTCOME:

- Get a strong understanding of .NET Visual Studio platform
- Become a strong knowledge in C# .NET.
- Getting real-time application developing using .NET Cloud Technologies.

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

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

IV SEMESTER

Coursecode	23CSCS405	MACHINELEARNING LAB	L	T	P	C
Core/Elective/Supportive		SEC-III			4	2
Pre-requisite	Basic Programming Skill and Data Knowledge					
Objectives of the Course	To preprocess the data and build ML models using appropriate techniques and evaluate the model					
Learning Outcome	<p>Upon completion of the course, the student will be able to</p> <p>CO1: Apply pandas, NumPy and Matplotlib to read in , process and visualise data, implement linear classification algorithms</p> <p>CO2: Compare classifiers with linear and non-linear decision boundaries, select relevant features for the model construction</p> <p>CO3: Apply data compression and best practices for model evaluation and hyper parameter tuning</p> <p>CO4: Select appropriate algorithms and ensemble</p> <p>CO5: Apply clustering algorithms on unlabelled data, construct a web application embedding a ML model</p>					
Course Outline	<p>UNIT-I :</p> <ol style="list-style-type: none"> 1. Programs using NumPy and pandas 2. Visualising using graphs 3. Perceptron learning algorithm 4. Adaline 					
	<p>UNIT-II :</p> <ol style="list-style-type: none"> 5. Training a perceptron 6. Modeling class probabilities via logistic regression 7. Maximum margin classification with support vector machines(SVM) 8. Solving nonlinear problems using a kernel SVM 9. Decision tree 					
	<p>UNIT-III :</p> <ol style="list-style-type: none"> 10. Unsupervised dimensionality reduction via principal component analysis 11. Supervised data compression via linear discriminant analysis 12. Using k-fold cross-validation to assess model performance 13. Debugging algorithms with learning and validation curves 14. Fine-tuning ML models via grid search 15. Implementing different performance evaluation metrics 					

	<p>UNIT-IV :</p> <p>16. Ensemble Learning</p> <p>17. Ordinary least squares linear regression model</p> <p>18. Evaluating the performance of linear regression models</p> <p>19. Regularised methods for regression</p> <p>20. Nonlinear relationships using random forests</p>
	<p>UNIT-V:</p> <p>21. Grouping objects by similarity using k-means</p> <p>22. Organising clusters as a hierarchical tree</p> <p>23. Locating regions of high density via DBSCAN</p> <p>24. Embedding a ML model into a Web Application</p>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	<p>1. Mini project applying ML concepts in existing / real time data</p> <p>2. Comparing the performance of different ML algorithms on a given dataset</p>
Skills acquired from this course	Preprocessing, ML steps, Prediction and Performance evaluation , Embedding ML model into a web application
Recommended Text	<p>1. Corey Wade et al, Vahid Mirjalili, The Python Workshop, 2nd Edition, packs publishing, 2022</p> <p>2. Sebastian Raschka and VahidMirjalili, Python Machine Learning, 3rd Edition, packt publishing, 2019</p>
Reference Books	<p>1. Andreas C. Mueller, Sarah Guido. Introduction to Machine Learning with Python. O'Reilly Media, Inc., 2016.</p> <p>2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Edition, http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012, 2010</p> <p>3. Wes McKinney. Python for Data Analysis. O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, second edition, 2018</p>
Website and e-Learning Source	<p>1. https://machinelearningmastery.com/machine-learning-in-python-step-by-step/</p> <p>2. https://www.tutorialspoint.com/machine_learning_with_python/index.htm</p> <p>3. https://pythonprogramming.net/machine-learning-tutorial-python-introduction/</p>

MappingwithProgrammeOutcomes:

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	S	M	S	S	S
CO2	S	S	M	S	M	M
CO3	S	M	S	S	M	M
CO4	S	M	S	M	S	M
CO5	S	S	M	S	S	M

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

IV SEMESTER

23CSCS206	SEC-III: NATURAL LANGUAGE PROCESSING LAB	C 2 P 4
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COURSE OBJECTIVES:

CO1 : To introduce the basics of language from algorithmic viewpoint

CO2 : To introduce about computational linguistics concepts

CO3: To develop various skills on NLP toolkits

CO4: To develop different analytic techniques

LIST OF PROGRAMS :

1. Implementing word similarity
2. Implementing simple problems related to word disambiguation
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic Analyzer.
- 6.Sentiment Analysis.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

1. Apply different natural language processing algorithms to different tasks
2. Apply different text analysers
3. Understand the different levels of automatic language processing

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

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