



**Annamalai University**

**Faculty of Science**

**DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE**

**Master of Computer Applications (TANSICHE syllabus)**

**Programme Code: SCIS23**

These rules and regulations shall govern the Two year post graduate studies leading to the award of degree of **Master of Computer Applications** in the Faculty of Science. These academic Regulations shall be called "**Annamalai University, Faculty of Science Two year Master of Computer Applications 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, Master of Computer Applications is a discipline in the Computer 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 Master of Computer Applications programme. The eligibility criteria and admission procedure are followed as per the guidelines of Tamil Nadu Common Entrance Test (TANCET).

### 2.1 **Eligibility Criteria prescribed by TANCET:**

Candidates must be graduate with Mathematics as a subject in graduation or at 10+2 level. Candidate must have secured at least 50 percent marks (open category) and 45 percent marks (reserved category) in the Bachelor's degree exam.

- 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 consists 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
	<b>TOTAL CREDITS</b>	<b>91</b>

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
<b>Test-I and Test-II</b>	15
<b>Seminar</b>	5
<b>Assignment</b>	5
<b>Total</b>	25

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

	Marks
<b>Test-I</b>	10
<b>Test-II</b>	10
<b>Viva-voce and Record</b>	05
<b>Total</b>	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



<b>Withdrawn from the examination</b>	0	W
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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.

<b>CGPA</b>	<b>CLASSIFICATION OF FINAL RESULT</b>
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**

$$\text{CGPA} \times 9.5 = \text{Percentage}$$

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.



<b>Programme</b>	<b>M.C.A.,</b>
<b>Programme Code</b>	<b>SCIS23</b>
<b>Duration</b>	<b>PG - Two Years</b>
<b>Programme Outcomes (Pos)</b>	<p><b>PO1: Problem Solving Skill</b> - Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p><b>PO2: Decision Making Skill</b> - Foster analytical and critical thinking abilities for data-based decision-making.</p> <p><b>PO3: Ethical Value</b> - Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p><b>PO4: Communication skill-</b> Ability to develop communication, managerial and interpersonal skills.</p> <p><b>PO5: Individual and Team Leadership Skill</b> - Capability to lead themselves and the team to achieve organizational goals.</p> <p><b>PO6: Employability Skill</b> - Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p><b>PO7: Entrepreneurial Skill</b> - Equip with skills and competencies to become an entrepreneur.</p> <p><b>PO8: Contribution to Society</b> - Succeed in career endeavors and contribute significantly to society.</p> <p><b>PO 9 Multicultural competence</b> - Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p> <p><b>PO 10: Moral and ethical awareness/reasoning</b> - Ability to embrace moral/ethical values in conducting one's life.</p>
<b>Programme Specific Outcomes (PSOs)</b>	<p><b>PSO1 – Placement</b> 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><b>PSO 2 - Entrepreneur</b> 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><b>PSO3 – Research and Development</b> Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.</p> <p><b>PSO4 – Contribution to Business World</b> To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p><b>PSO 5 – Contribution to the Society</b> To contribute to the development of the society by collaborating with stakeholders for mutual benefit.</p>

### Programme Outcomes (Po) - Programme Specific Outcomes (Pso) Mapping

PROGRAMME SPECIFIC OUTCOMES (PSO)										
	PS1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	3	3	3	3	3	3	3	3	3	3
PSO2	3	3	3	3	3	3	3	3	3	3
PSO3	3	3	3	3	3	3	3	3	3	3
PSO4	3	3	3	3	3	3	3	3	3	3
PSO5	3	3	3	3	3	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**

<b>Programme</b>	<b>M.C.A.,</b>
<b>Programme Code</b>	<b>SCIS23</b>
<b>Duration</b>	<b>PG - Two Years</b>
<b>Programme Outcomes (Pos)</b>	<p><b>PO1: Problem Solving Skill</b> - Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context.</p> <p><b>PO2: Decision Making Skill</b> - Foster analytical and critical thinking abilities for data-based decision-making.</p> <p><b>PO3: Ethical Value</b> - Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.</p> <p><b>PO4: Communication skill</b>- Ability to develop communication, managerial and interpersonal skills.</p> <p><b>PO5: Individual and Team Leadership Skill</b> - Capability to lead themselves and the team to achieve organizational goals.</p> <p><b>PO6: Employability Skill</b> - Inculcate contemporary business practices to enhance employability skills in the competitive environment.</p> <p><b>PO7: Entrepreneurial Skill</b> - Equip with skills and competencies to become an entrepreneur.</p> <p><b>PO8: Contribution to Society</b> - Succeed in career endeavors and contribute significantly to society.</p> <p><b>PO 9 Multicultural competence</b> - Possess knowledge of the values and beliefs of multiple cultures and a global perspective.</p> <p><b>PO 10: Moral and ethical awareness/reasoning</b> - Ability to embrace moral/ethical values in conducting one's life.</p>
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### Programme Outcomes (Po) - Programme Specific Outcomes (Pso) Mapping

PROGRAMME SPECIFIC OUTCOMES (PSO)										
	PS1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	3	3	3	3	3	3	3	3	3	3
PSO2	3	3	3	3	3	3	3	3	3	3
PSO3	3	3	3	3	3	3	3	3	3	3
PSO4	3	3	3	3	3	3	3	3	3	3
PSO5	3	3	3	3	3	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**  
**Master of Computer Applications (Two year programme)**  
**Programme Code: SCIS23**

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

Course Code	Course Title	Credit	Hours /Week	Examination Duration(Hrs)	Marks		
					CI A	ESE	Total
<b>Semester-I</b>							
23MCAC101	Core –I Theory: Discrete Mathematics	4	6	3	25	75	100
23MCAC102	Core-II Theory: Linux and shell programming	5	7	3	25	75	100
23MCAC103	Core-III Theory: Advanced Java Programming	5	7	3	25	75	100
23MCAE104	Elective – I	3	5	3	25	75	100
23MCAE105	Elective – II	3	5	3	25	75	100
<b>Total Credit</b>		<b>20</b>	<b>30</b>	<b>Total Marks</b>			<b>500</b>

<b>Semester-II</b>							
23MCAC201	Core-IV Theory: Data Structures and Algorithms	5	6	3	25	75	100
23MCAC202	Core-V Theory: Advanced Computer Network	5	6	3	25	75	100
23MCAP203	Core –VI Practical: Data Structures and Algorithms Lab	4	6	3	25	75	100
23MCAE204	Elective - III	3	4	3	25	75	100
23MCAE205	Elective – IV	3	4	3	25	75	100
23MCAS206	Skill Enhancement Course [SEC] - I	2	4	3	25	75	100
<b>Total Credit</b>		<b>22</b>	<b>30</b>	<b>Total Marks</b>			<b>600</b>

<b>Semester-III</b>							
23MCAC301	Core-VII Theory: Python Programming	5	6	3	25	75	100
23MCAC302	Core-VIII Theory: Web Technology	5	6	3	25	75	100
23MCAC303	Core-IX Theory: Advanced Machine Learning (AML) Techniques	5	6	3	25	75	100
23MCAP304	Core-X Practical: Integrated technology (AML) Lab	4	6	3	25	75	100
23MCAE305	Elective-V	3	3	3	25	75	100
23MCAS306	Skill Enhancement Course[SEC] - II	2	3	3	25	75	100
23MCAI307	Internship / Industrial Activity	2	-	-	-	-	100
<b>Total Credit</b>		<b>26</b>	<b>30</b>	<b>Total Marks</b>		<b>700</b>	
<b>Semester-IV</b>							
23MCAC401	Core – XI Theory: Industry Dynamics Technology- Data Visualisation	5	6	3	25	75	100
23MCAC402	Core – XII Theory: Big Data Analytics	5	6	3	25	75	100
23MCAD403	Project with Viva voce	7	10	-	25	75	100
23MCAE404	Elective – VI	3	4	3	25	75	100
23MCAS405	Skill Enhancement Course[SEC] - III	2	4	3	25	75	100
23MCAX406	Extension Activity	1	-	-	-	-	-
<b>Total Credit</b>		<b>23</b>	<b>30</b>	<b>Total Marks</b>		<b>500</b>	
<b>Over all Credit Score</b>		<b>91</b>	<b>120</b>	<b>Over all Total Marks</b>		<b>2300</b>	



## **List of Electives courses**

### **Elective-I:**

Data Engineering and Management /Data Engineering and Management Lab  
High Performance Computing /High Performance Computing Lab

### **Elective-II:**

Dot Net Technologies/Dot Net Technologies lab  
Architecture and Frameworks /Architecture and Frameworks lab

### **Elective-III:**

Cryptography and Network Security /Cryptography and Network Security Lab  
Network Protocols / Network Protocols Lab

### **Elective-IV:**

Computer Vision / Computer Vision Lab  
Solution Architecture / Solution Architecture Lab

### **Elective-V:**

Mobile Computing / Mobile Application Development Lab  
Optimization Techniques / Optimization Techniques Lab

### **Elective-VI:**

Soft Computing / Soft Computing Lab  
Internet of Things /Internet of Things Lab

### **Skill Enhancement Course [SEC] – I:**

Software Development Technologies  
Optimization Techniques

### **Skill Enhancement Course [SEC] – II:**

Web Technology Lab  
Social Networks Lab

### **Skill Enhancement Course [SEC] – III:**

Cyber Security Lab  
Blockchain Technology Lab

Semester	23MCAC101:Discrete Mathematics	L	P	C
I		6	0	4

### Course Objective

- To know the concepts of relations and functions
- To distinguish among different normal forms and quantifiers
- To solve recurrence relations and permutations & combinations
- To know and solve matrices , rank of matrix & characteristic equations
- To study the graphs and its types

### Unit-I

**Relations-** Binary relations-Operations on relations- properties of binary relations in a set – Equivalence relations— Representation of a relation by a matrix -Representation of a relation by a digraph – **Functions**-Definition and examples-Classification of functions-Composition of functions-Inverse function

### Unit-II

**Mathematical Logic**-Logical connectives-**Well formed formulas** – Truth table of well formed formula –Algebra of proposition –Quine’s method- **Normal forms of well formed formulas**-Disjunctive normal form-Principal Disjunctive normal form-Conjunctive normal form-Principal conjunctive normal form-**Rules of Inference for propositional calculus** – **Quantifiers**-Universal Quantifiers- Existential Quantifiers

### Unit-III

**Recurrence Relations-** Formulation -solving recurrence Relation by Iteration- solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of Order Two- Solving Linear Non homogeneous Recurrence Relations. **Permutations**-Cyclic permutation-Permutations with repetitions- permutations of sets with indistinguishable objects-**Combinations**- Combinations with repetition

### Unit-IV

**Matrices-** special types of matrices-Determinants-Inverse of a square matrix-Cramer’s rule for solving linear equations-Elementary operations-Rank of a matrix-solving a system of linear equations-characteristic roots and characteristic vectors-Cayley-Hamilton Theorem-problems

### Unit-V

**Graphs** -Connected Graphs -Euler Graphs- Euler line-Hamiltonian circuits and paths –planar graphs – Complete graph-Bipartite graph-Hyper cube graph-Matrix representation of graphs

**Text book:**

1. N.Chandrasekaran and M.Umaparvathi, Discrete mathematics, PHI Learning Private Limited, New Delhi, 2010.

**Reference Book:**

1. Kimmo Eriksson &Hillevi Gavel, Discrete Mathematics & Discrete Models, Studentlitteratur AB, 2015.
2. Kenneth H. Rosen Discrete Mathematics and applications, Mc Graw Hill, 2012

**Course Outcomes**

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

CO1:	To understand the concepts of relations and functions distinguish among normal forms	K2	IO
CO2:	To analyze and evaluate the recurrence relations	K4,K5	HO
CO3:	To distinguish among various normal forms and predicate calculus	K5	HO
CO4:	To solve and know various types of matrices	K1	LO
CO5:	To evaluate and solve various types of graphs	K5	HO

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

Semester	23MCAC102:Linux and Shell Programming	L	P	C
I		7	0	5

## Course Objective

- To teach principles of operating system including File handling utilities, Basic Linux commands, Scripts and filters.
- To familiarize fundamentals of shell (bash), shell programming, pipes, Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
- To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
- To facilitate students in understanding Inter process communication, semaphore and shared memory.
- To explore real-time problem solution skills in Shell programming.

## Unit-I

**Basic bash Shell Commands:** Interacting with the shell-Traversing the file system-Listing files and directories-Managing files and directories-Viewing file contents. **Basic Script Building:**Using multiple commands-Creating a script file-Displaying messages-Using variables-Redirecting input and output-Pipes-Performing math-Exiting the script. **Using Structured Commands:**Working with the if-then statement-Nesting ifs-Understanding the test command-Testing compound conditions-Using double brackets and parentheses-Looking at case.

(Book-1, Chapters: 3, 11, and 12)

## Unit-II

**More Structured Commands:** Looping with for statement-Iterating with the until statement-Using the while statement-Combining loops-Redirecting loop output. **Handling User Input:** Passing parameters-Tracking parameters-Being shifty-Working with options-Standardizing options-Getting user input. **Script Control:** Handling signals-Running scripts in the background-Forbidding hang-ups -Controlling a Job-Modifying script priority-Automating script execution.

(Book-1, Chapters: 13, 14, and 16)

## Unit-III

**Creating Functions:** Basic script functions-Returning a value-Using variables in functions-Array and variable functions-Function recursion-Creating a library-Using functions on the command line. **Writing Scripts for Graphical Desktops:** Creating text menus-Building text window widgets-Adding X Window graphics. **Introducing sed and gawk:** Learning about the sed Editor-Getting introduced to the gawk Editor-Exploring sed Editor basics.

(Book-1, Chapters: 17, 18, and 19)

## Unit-IV

**Regular Expressions:** Defining regular expressions-Looking at the basics-Extending our patterns-Creating expressions. **Advanced sed:** Using multiline commands-Understanding the hold space-Negating a command-Changing the flow-Replacing via a pattern-Using sed in scripts-Creating sed utilities. **Advanced gawk:** Reexamining gawk-Using variables in gawk-Using structured commands-Formatting the printing-Working with functions.

(Book-1, Chapters: 20, 21, and 22)

## Unit-V

**Working with Alternative Shells:** Understanding the dash shell-Programming in the dash shell-Introducing the zsh shell-Writing scripts for zsh.**Writing Simple Script Utilities:** Automating backups-Managing user accounts-Watching disk space. **Producing Scripts for Database, Web, and E-Mail:** Writing database shell scripts-Using the Internet from your scripts-Emailing reports from scripts. **Using Python as a Bash Scripting Alternative:** Technical requirements-Python Language-Hello World the Python way-Pythonic arguments-Supplying arguments-Counting arguments-Significant whitespace-Reading user input-Using Python to write to files-String manipulation.

(Book-1, Chapters: 23, 24, 25, and Book-2, Chapter: 14)

### Text book:

1. Richard Blum, Christine Bresnahan, “Linux Command Line and Shell Scripting BIBLE”, Wiley Publishing, 3<sup>rd</sup> Edition, 2015.**Chapters:** 3, 11 to 14, 16 to 25.
2. Mokhtar Ebrahim, Andrew Mallett, “Mastering Linux Shell Scripting”, Packt Publishing, 2<sup>nd</sup> Edition, 2018. **Chapter:** 14.

### Reference Books:

1. ClifFlynt,,SarathLakshmanShantanuTushar, “Linux Shell Scripting Cookbook ”, Packt Publishing, 3<sup>rd</sup> Edition, 2017.
2. Stephen G.Kochan, Patrick Wood, “Shell Programming in Unix, Linux, and OS X”, Addison Wesley Professional, 4<sup>th</sup> Edition, 2016.
3. Robert Love, “Linux System Programming”, O'Reilly Media, Inc, 2013
4. W.R. Stevens, “Advanced Programming in the UNIX environment”, 2nd Edition, Pearson Education, 2013
5. Graham Glass, King Ables, “ UNIX for Programmers and Users”, 3rd Edition, Pearson Education, 2003

### Course Outcomes

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

CO1:	To understand, apply and analyze the concepts and methodology of Linux shell programming	K1-K6
CO2:	To comprehend, impart and apply fundamentals of control structure and script controls	K1-K6
CO3:	To understand, analyses and evaluate the functions, graphical desktop interface and editors	K1-K6
CO4:	To collaborate, apply and review the concepts and methodology of regular expression and advanced gawk	K1-K6
CO5:	To comprehend, use and illustrate the advance concepts such as alternate shell script, data connectivity and bash scripting using python	K1-K6

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

#### Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	-	S	L	-	M	M	M
CO 2	S	S	M	-	S	L	-	M	M	M
CO 3	S	S	M	-	S	L	-	M	M	S
CO 4	S	S	M	-	S	L	-	M	M	M
CO 5	S	S	M	-	S	L	-	M	M	M

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



Semester		L	P	C
I	<b>23MCAC103:Advanced Java Programming</b>	7	0	5

### Course Objectives

- To gain knowledge of Object Oriented Programming Concept in Java
- To understand usages of String functions in Java
- To familiarize with the applet and swing
- To grasp the concepts on Java Beans
- To comprehend the connection between Relational Database and Java.

### Unit – I

An Overview of Java: Object Oriented Programming- Data Types, Variables, and Arrays: Primitive Types-Literals Variables - Type Conversion and Casting- Arrays-Operators: Control Statements-Classes and Methods – Inheritance- Exception Handling.

### Unit – II

String Handling: The String Constructors - String Length - Special String Operations - Character Extraction - String Comparison - Searching Strings - Modifying a String - Input/Output: The I/O Classes and Interfaces – File - Byte Streams - Character Streams.

### Unit – III

The Applet Class: Basic Architecture - Applet Skeleton - Display methods - Status Window – Passing Parameters. Introducing GUI Programming with Swing– Introducing Swing - Swing Is Built on the AWT- Two Key Swing Features - The MVC Connection - Components and Containers - The Swing Packages - A Simple Swing Application - Exploring Swing.

### Unit- IV

Java Beans: Introduction - Advantages of Beans – Introspection - The JavaBeans API - A Bean Example. Servlets: Life Cycle Simple Servlet-Servlet API-Packages-Cookies session tracking.

### Unit – V

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

### Text Books:

1. Herbert Schildt, “Java the Complete Reference”, 10<sup>th</sup> edition, McGraw Hill Publishing Company Ltd, New Delhi, 2017.
2. Tony Goddis, “Starting out with Java from Control Structures Through Objects” 6th Edition, Pearson Education Limited, 2016

### Reference Books:

1. Herbert Schildt, Dale Skrien, "Java Fundamentals – A Comprehensive Introduction", TMGH Publishing Company Ltd, New Delhi, 2013
2. John Dean, Raymond Dean, "Introduction to Programming with JAVA – A Problem Solving Approach", TMGH Publishing Company Ltd, New Delhi, 2012.

### Course Outcomes

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

CO1:	Understand the Object Oriented Program including classes and methods; inheritance and exception handling	K1-K6
CO2:	Complete comprehension of String functions and I/O Streams	K1-K6
CO3:	Creation of graphical representation using Applet	K1-K6
CO4:	Application of Servlets for designing Web based applications	K1- K6
CO5:	Usage of JDBC connectivity and implementation of the concept to get desired results from database	K1-K6

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

### Mapping with Programme Outcomes

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

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

<b>Semester</b>	<b>23MCAC201:Data Structures and Algorithms</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>6</b>	<b>0</b>	<b>5</b>

### Course Objectives:

- To get a clear understanding of various ADT structures.
- To understand how to implement different ADT structures with real-time scenarios.
- To analyze the various data structures with their different implementations.
- To get an idea of applying right models based on the problem domain.
- To realize, and understand how and where to implement modern data structures with Python language.

### Unit-I

**Abstract Data Types:** Introduction-Date Abstract Data Type-Bags-Iterators. **Arrays:** Array Structure-Python List-Two Dimensional Arrays-Matrix Abstract Data Type. **Sets, Maps:** Sets-Maps- Multi-Dimensional Arrays.

### Unit-II

**Algorithm Analysis:** Experimental Studies-Seven Functions-Asymptotic Analysis. **Recursion:** Illustrative Examples-Analyzing Recursive Algorithms-Linear Recursion- Binary Recursion-Multiple Recursion.

### Unit-III

**Stacks, Queues, and Deques:** Stacks- Queues- Double-Ended Queues Linked. **Lists:** Singly Linked Lists-Circularly Linked Lists-Doubly Linked Lists. **Trees:** General Trees-Binary Trees-Implementing Trees-Tree Traversal Algorithms.

### Unit-IV

**Priority Queues:** Priority Queue Abstract Data Type- Implementing a Priority Queue- Heaps-Sorting with a Priority Queue. **Maps, Hash Tables, and Skip Lists:** Maps and Dictionaries-Hash Tables- Sorted Maps-Skip Lists-Sets, Multisets, and Multimaps.

### Unit-V

**Search Trees:** Binary Search Trees-Balanced Search Trees-AVL Trees-Splay Trees. **Sorting and Selection:** Merge sort-Quick sort-Sorting through an Algorithmic Lens- Comparing Sorting Algorithms-Selection. **Graph Algorithms:** Graphs-Data Structures for Graphs-Graph Traversals-Shortest Paths-Minimum Spanning Trees.

### Text book:

1. Rance D. Necaie, “Data Structures and Algorithms Using Python”, John Wiley & Sons, 2011. (Unit – 1) **Chapters:** 1, 2, 3.

2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, John Wiley & Sons, 2013. (Unit – 2, 3, 4, and 5)**Chapters:** 3 to 12, and 14.

**Reference books:**

1. Dr. Basant Agarwal; Benjamin Baka, “Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7”, Packt Publishing, 2018.
2. Magnus Lie Hetland, “Python Algorithms: Mastering Basic Algorithms in the Python Language”, Apress, 2014.

**Course Outcome:**

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

CO1	Understand various ADT concepts	K1-K6
CO2	Familiar with implementation of ADT models with Python language and understand how to develop ADT for the various real-time problems	
CO3	Apply with proper ADT models with problem understanding	
CO4	Apply and Analyze right models based on the problem domain	
CO5	Evaluate modern data structures with Python language	

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

**Mapping with Programme Outcomes:**

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

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

<b>Semester</b>	<b>23MCAC202:Advanced Computer Network</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>6</b>	<b>0</b>	<b>5</b>

### Course Objectives

- Study the advanced concepts of the computer networking and enumerate the layers and TCP/IP model.
- Acquire knowledge of Wireless communication and Data link layer.
- Understand the data links and protocols.
- Gain core knowledge of Network layer routing protocols and IP addressing.
- Study the transport layer and network security

**Unit 1 - Introduction** – Network Hardware – Software – Reference Models – OSI and TCP/IP models – Example networks: Internet, 3G Mobile phone networks, Wireless LANs – RFID and sensor networks - Physical layer – Theoretical basis for data communication - guided transmission media

**Unit-2-Wireless transmission-Communication Satellites**–

Digital modulation and multiplexing - Telephones network structure – local loop, trunks and multiplexing, switching. Data link layer: Design issues – error detection and correction.

**Unit 3-Elementary data link protocols**- sliding window protocols – Example Data Link protocols – Packet over SONET, ADSL-Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols.

**Unit 4-Network layer**- design issues - Routing algorithms - Congestion control algorithms – Quality of Service – Network layer of Internet- IP protocol – IP Address – Internet Control Protocol.

**Unit 5-Transport layer** – transport service- Elements of transport protocol - Addressing, Establishing & Releasing a connection – Error control, flow control, multiplexing and crash recovery-Internet Transport Protocol – TCP- Network Security: Cryptography.

### Text Book:

1. Andrew S Tanenbaum (2018), “Computer Networks”, Low price Edition, Fourth Edition.

### Reference Books:

1. Teresa C. Piliouras (2015), “Network Design Management and Technical Perspectives”, Auerbach Publishers, Second Edition.
2. <https://www.pdfdrive.com/advanced-computing-networking-and-informatics-volume-1-advanced-computing-and-informatics-proceedings-of-the-second-international-conference->

**Course Outcomes(CO):**

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

<b>CO1</b>	Understand the terminology and concepts of the OS reference model
<b>CO2</b>	Student will get the knowledge of protocols, network interfaces, and design issues in local area networks and wide area networks.
<b>CO3</b>	Understand wireless networking concepts, and be familiar with contemporary issues in networking technologies.
<b>CO4</b>	Gain knowledge of network tools and network programming.
<b>CO5</b>	Understand the Establishing and Releasing a connection in transport layer.

**Outcome Mapping**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>			S		M	S			M	M
<b>CO2</b>				L	S	M		S		M
<b>CO3</b>	S			S		S		M		L
<b>CO4</b>	S		S	M	M	S		L		S
<b>CO5</b>		S					S		M	



<b>Semester</b>	<b>23MCAP203:Data Structures and Algorithms Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>0</b>	<b>6</b>	<b>4</b>

**Course Objectives:**

- To understand Stack , Queue and Doubly Linked ADT structures.
- To implement different ADT structures with real-time scenarios.
- To analyze the recursion concepts.
- To apply different sorting and tree techniques.
- To implement modern data structures with Python language.

**Implement the following problems using Python 3.4 and above**

1. Recursion concepts.
  - i) Linear recursion
  - ii) Binary recursion.
2. Stack ADT.
3. Queue ADT.
4. Doubly Linked List ADT.
5. Heaps using Priority Queues.
6. Merge sort.
7. Quick sort.
8. Binary Search Tree.
9. Minimum Spanning Tree.
10. Depth First Search Tree traversal.

**Course Outcome:**

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

CO1	Strong understanding in various ADT concepts	K1-K6
CO2	To become a familiar with implementation of ADT models	
CO3	Apply sort and tree search algorithms	
CO4	Evaluate the different data structure models	
CO5	Learn how to develop ADT for the various real-time problems	

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

**Mapping with Programme Outcomes:**

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

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

<b>Semester</b>	<b>23MCAC301:Python Programming</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>6</b>	<b>0</b>	<b>5</b>

**Course Objectives:**

- To acquire programming skills in core Python
- To learn Strings and function
- To develop object oriented skills in Python
- To comprehend various Python Packages
- To develop web applications using Django

**Unit I**

Introduction : Fundamental ideas of Computer Science - Strings, Assignment, and Comments - Numeric Data types and Character sets – Expressions – Loops and Selection Statements: Definite iteration: the for Loop - selection: if and if-else statements - Conditional iteration: the while Loop

**Unit II**

Strings and Text Files: Accessing Characters and substrings in strings - Data encryption-Strings and Number systems- String methods – Text - Lists and Dictionaries: Lists – Dictionaries – Design with Functions: A Quick review - Problem Solving with top-Down Design - Design with recursive Functions - Managing a Program’s namespace - Higher-Order Functions

**Unit III**

Design with Classes: Getting inside Objects and Classes – Data-Modeling Examples – Building a New Data Structure – The Two – Dimensional Grid - Structuring Classes with Inheritance and Polymorphism - GraphicalUser Interfaces - The Behavior of terminal-Based programs and GUI-Based programs - Coding Simple GUI-Based programs - Windows and Window Components - Command Buttons and responding to events

**Unit IV**

Working with Python Packages: NumPy Library-Ndarray – Basic Operations – Indexing, Slicing and Iteration – Array manipulation - Pandas –The Series – The DataFrame - The Index Objects – Data Vizualization with Matplotlib – The Matplotlib Architecture – pyplot – The Plotting Window – Adding Elements to the Chart – Line Charts – Bar Charts – Pie charts

## Unit V

Django: Installing Django – Building an Application – Project Creation – Designing the Data Schema - Creating an administration site for models - Working with QuerySets and Managers – Retrieving Objects – Building List and Detail Views

### Text Book:

1. K.A. Lambert, “Fundamentals of Python: first programs”, Second Edition, Cengage Learning, 2018 (**Unit - I, II and III**)
2. Fabio Nelli, “Python Data Analytics: With Pandas, NumPy, and Matplotlib”, Second Edition, Kindle Edition, 2018 (**Unit - IV**)
3. Antonio Mele, “Django 3 By Example”, Third Edition, 2020 (**Unit - V**)

### Course Outcomes

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

<b>CO1</b>	Comprehend the programming skills in python and develop applications using conditional branches and loop	<b>K1- K6</b>
<b>CO2</b>	Create python applications with strings and functions	
<b>CO3</b>	Understand and implement the Object Oriented Programming paradigm with the concept of objects and classes, Inheritance and polymorphism	
<b>CO4</b>	Evaluate the use of Python packages to perform numerical computations and data vizualization	
<b>CO5</b>	Design interactive web applications using Django	

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

### Mapping with Programme Outcomes

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

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

<b>Semester</b>	<b>23MCAC302:Web Technology</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>6</b>	<b>0</b>	<b>5</b>

### **Course Objectives:**

- Understand the fundamentals of the web and thereby develop web applications using various development languages and tools.
- Enrich knowledge about XHTML control and Cascading Style Sheets.
- Provide in- depth knowledge about Javascript.
- To enhance knowledge in XML documents with presentations using CSS and XSLT.
- Deliver depth knowledge about PHP, Angular JS, JQuery.

### **UNIT -I**

**WEB FUNDAMENTALS AND HTML:** A Brief Introduction to the Internet - The World Wide Web - Web Browsers - Web Servers -URLs, MIME, HTTP, Security- Introduction to HTML- Origins and Evolution of HTML and HTML - Basic Syntax - Standard HTML Document Structure - Basic Text Markup - Images- Hypertext Links - Lists, Tables, Forms, The Audio Element, The Video Element - Organization Elements, The Time Element

### **UNIT – II**

**INTRODUCTION TO XHTML AND CSS:** Basic syntax, Standard structure, Basic text-markup, Images, Hypertext Links. Lists, Tables, Forms, Frames, syntactic differences between HTML and XHTML-Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The<span> and <div>tags, Conflict resolution.

### **UNIT - III**

**THE BASICS OF JAVASCRIPT:** Overview of JavaScript, Object orientation and JavaScript, general Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts.

**JAVASCRIPT AND XHTML DOCUMENTS:** The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Model

### **UNIT- IV**

**DYNAMIC DOCUMENTS WITH JAVASCRIPT AND XML:** Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Color and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements. Introduction to XML, Syntax of XML, XML Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT Style Sheets, Web services.

## UNIT - V

**PHP, ANGULAR JS AND JQUERY:** Introduction to PHP: Overview of PHP -General Syntactic Characteristics - Primitives, Operations, and Expressions - Output - Control Statements - Arrays - Functions - Pattern Matching - Form Handling - Cookies - Session Tracking - Introduction to JQuery, Syntax, selectors, events, JQuery HTML, JQuery Effects, JQuery CSS. Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations, Examples.

### Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, Eighth Edition, Pearson education, 2015. **UNITS:** 1,2,3,4
2. Dayley Brad, Dayley Brendan ,”AngularJS, JavaScript, and jQuery All in One”, Sams Teach Yourself 1st Edition, Kindle Edition, 2015.**UNIT:** 5

### Reference Books:

1. M. Srinivasan: Web Programming Building Internet Applications, 3<sup>rd</sup>Edition, Wiley India, 2009.
2. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7<sup>th</sup>Impression,2012.
3. Chris Bates: Web Technology Theory and Practice, Pearson Education, 2012.
4. Raj Kamal: Internet and Web Technologies, McGraw Hill Education.

### Course Outcomes:

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

CO1	Design dynamic web pages using Javascript, JQuery and Angular JavaScript	K1	LO
CO2	Develop Web pages using HTML, CSS and XML	K2	IO
CO3	Create web application using PHP and MySQL	K3, K4	HO
CO4	To design dynamic web pages using Angular javascript	K2,K3	HO
CO5	Develop interactive web pages using JQuery	K4,K5	HO



## Mapping with Programme Outcomes

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

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

Semester	23MCAC303:Advanced Machine Learning Techniques	L	P	C
III		6	0	5

## Course Objectives

- To understand the concepts of Machine Learning.
- To understand the theoretical and practical aspects of types of machine learning
- To teach and get familiarized with supervised learning and their applications.
- To teach and get familiarized with the concepts and algorithms of unsupervised learning.
- To appreciate the concepts and algorithms of deep learning.

### Unit I:

**Introducing Machine Learning:**The Origins of Machine Learning, Uses and Abuses of Machine Learning \_ Basics of Machine Learning Algorithm Model Works - Steps to apply Machine Learning - Choosing a Machine Learning Algorithm - Using Machine Learning concepts.

**Managing and Understanding Data:** Data Structures, Vectors And Factors: Lists, Data frames, Matrixes and arrays - Managing Data - Exploring and Understanding Data: Exploring the Structure of Data, Exploring Numeric variables - Exploring Categorical Variables- Exploring Relationships between Variables.

### Unit II:

Lazy Learning – **Classification Using Nearest Neighbors:**ThekNN Algorithm- Diagnosing Breast Cancer with the kNN Algorithm- Probabilistic Learning – Classification Using Naive Bayes: Basic concepts of Bayesian Methods- The Naïve Bayes Algorithm- Example – filtering Mobile Phone Spam with the Naive Bayes Algorithm.

Divide and Conquer – **Classification Using Decision Trees and Rules:** Understanding Decision Trees- Example – Identifying Risky Bank Loans using C5.0 Decision Trees- Understanding Classification Rules- Example – Identifying Poisonous Mushrooms with Rule Learners.

### Unit III:

Forecasting Numeric Data – **Regression Methods:**Understanding Regression- Example – Predicting Medical Expenses using Linear Regression- Understanding Regression Trees and Model Trees- Example – Estimating the Quality of Wines with Regression Trees and Model Trees.

Black Box Methods Neural Networks and Support Vector Machines: Understanding Neural Networks, from Biological to Artificial Neurons, Activation Functions, Network Topology, Training Neural Networks with Backpropagation - Modeling the Strength of Concrete with ANNs- Understanding Support Vector Machines- Performing OCR with SVMs- Finding Patterns – Market Basket Analysis Using Association Rules: Understanding Association Rules- Example – Identifying Frequently Purchased Groceries with Association Rules.

## **Unit IV:**

Finding Groups of Data – **Clustering with K-Means:** Understanding Clustering- The k-means Algorithm for clustering- Finding teen market segments using k-means Clustering- Evaluating Model Performance: Measuring Performance for Classification- Beyond Accuracy – other Measures of Performance, Visualizing Performance Tradeoffs.

Improving Model Performance: Tuning Stock Models for Better Performance-Using Caret for Automated Parameter Tuning- Creating a simple Tuned Model- Customizing the Tuning Process- Improving Model Performance with meta-learning- Understanding Ensembles- Bagging- Boosting- Random forests.

## **Unit V:**

**Introduction to Deep Learning:** Introduction to Deep Learning, Single Layer Perceptron Model (SLP), Multilayer Perceptron Model (MLP), Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Restricted Boltzmann Machines (RBMs).

**Convolutional Neural Networks (CNNs):** Structure and Properties of CNNs - Components of CNN Architectures- Convolutional Layer, Pooling Layer, Rectified Linear Units (ReLU) Layer, Fully Connected (FC) Layer, Loss Layer - Tuning Parameters ,Notable CNN Architectures, Regularization- Recurrent Neural Networks (RNNs): Fully Recurrent Networks, Training RNNs with Back-Propagation Through Time (BPPT)- Elman Neural Networks, Neural History Compressor, Long Short-Term Memory (LSTM), Traditional and Training LSTMs - Structural Damping Within RNNs, Tuning Parameter Update Algorithm.

## **Text Books:**

1. Brett Lantz, “Machine Learning with R”, Addison-Wesley Packt Publishing, 2013.
2. TawehBeysolow, “Introduction to Deep Learning Using R: A Step-by-Step Guide to Learning and Implementing Deep Learning Models Using R”, San Francisco, California, USA, 2017.

## **Reference Books:**

1. Daniel T. Larose, Chantal D. Larose, “Data mining and Predictive analytics”, Second Ed., Wiley Publication, 2015.
2. Bertt Lantz, “Machine Learning with R: Expert techniques for predictive modeling”, 3rd Edition, April 15,2019,
3. Jason Bell, “Machine Learning: Hands-On for Developers and Technical Professionals”, Wiley Publication,2015.

## Course Outcomes

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

CO1	To understand, impart and analyze the concepts and of Machine Learning Techniques and types of data	K1-K6
CO2	To comprehend, apply and evaluate the classification techniques for real-world applications	K1-K6
CO3	To understand, use and perform evaluation of Regression methods	K1-K6
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	K1-K6
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	K1-K6

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

## Mapping with Programme Outcomes

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

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

<b>Semester</b>	<b>23MCAP304: Integrated Technology (AML) Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>0</b>	<b>6</b>	<b>4</b>

### Course Objectives

- To formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To apply machine learning algorithms to solve problems of moderate complexity.
- To apply CNN to solve problems of moderate complexity.
- To apply LSTM and RNN to solve problems.

### List of Programs

1. Write a python program to compute the Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation
2. Implement a Linear Regression and Multiple Linear Regression with a Real Dataset
3. Implementation of Logistic Regression using sklearn
4. Implement a binary classification model.
5. Classification with Nearest Neighbours and NavieBaye Algorithm
6. Implementation Decision tree for classification using sklearn and its parameter tuning
7. Implement the k-means algorithm.
8. Implement an Image Classifier using CNN in TensorFlow/Keras.
9. Implement an Autoencoder in TensorFlow/Keras.
10. Implement a SimpleLSTM using TensorFlow/Keras.

### Course Outcomes

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

<b>CO1</b>	To understand and implement the mathematical and statistical prospective of machine learning algorithms through python programming	<b>K1-K6</b>
<b>CO2</b>	To recognize and develop the machine learning models through python in built functions	<b>K1-K6</b>
<b>CO3</b>	To understand, impart and develop the machine learning models for real-time dataset	<b>K1-K6</b>
<b>CO4</b>	To comprehend , impart and implement the deep learning models for real-time applications	<b>K1-K6</b>
<b>CO5</b>	To identify and evaluate the performance machine learning models for real-time dataset	<b>K1-K6</b>

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

### Mapping with Programme Outcomes

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

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

Semester	23MCAC401:Industry Dynamics Technology - Data Visualisations	L	P	C
IV		6	0	5

### Course Objectives:

To understand the concepts and significance of data visualization.

To learn the visualization idioms and map data attributes to graphical attributes.

To evaluate the effectiveness of visualization designs.

To comprehend the considerations in information dashboard design.

### UNIT - I Introduction

Visualization Definition and Need – Data Abstraction – Data Semantics and Types - Data Types – Dataset Types (DL) – Attribute Types – Semantics – Task Abstraction – Analyze tasks abstractly – Actions– Targets – Analyzing and Deriving.

### UNIT - II Analysis

Four levels for Validation – Reasons to Validate – Four levels of Design – Angles of Attack – Threats to Validity – Validation Approaches – Validation Examples – Marks and Channels – Defining Marks and Channels – Using Marks and Channels – Channel Effectiveness – Relative versus Absolute Judgements – Rules of Thumb to be followed – No unjustified 3D - No unjustified 2D – Eyes beat memory – Resolution over Immersion – Overview, Zoom, Filter, Details on demand – Responsiveness is required – Get it Right in Black and White.

### UNIT - III Tables and Spatial Data

Arrange by Keys and Values – Express: Quantitative Values – Separate, Order, and Align: Categorical Regions – Matrix Alignment: Two Keys – Volumetric Grid: Three Keys – Recursive Subdivision: Multiple Keys – Spatial Axis Orientation – Spatial Layout Density – Arrange Spatialdata – Geometry – Scalar Fields: One Value – Vector Fields: Multiple Values – Tensor Fields: Many Values.

### UNIT - IV Networks, Trees, Map Color

Connection: Link Marks – Matrix Views - Connection versus Matrix – Containment: Hierarchy Marks – Map Color and Other Channels – Color Theory – Color maps – Other Channels – Reduce items and attributes – Reasons to Reduce - Filter – Aggregate – Manipulate View – Reasons for Change - Change View over Time – Select Elements – Navigate: Changing Viewpoint, Reducing Attributes.

### UNIT – V Information Dashboard Design

Dashboards – Purpose – Importance – Reasons for Failure – Common Mistakes in Dashboard Design – Assessing what is needed from dashboards – Fundamental considerations in dashboard design – Visual perception and cognition to design dash board – An ideal library of graphs useful on dashboards.

### Text Books:

1. Tamara Munzner, “Visualization Analysis and Design”, CRC Press, 2014.

2. Stephen Few, “Information Dashboard Design: Displaying Data for At-a-glance Monitoring”, Analytics Press, Second Edition,2013.

**Reference Books:**

1. Ben Fry, “Visualizing Data”, O’Reilly, 2008.
2. Andy Kirk, “Data Visualization: A Successful Design Process”, PACKT Publishing, 2012.
3. Alexander Telea, “Data Visualization Principles and Practice”, CRC Press, Second Edition, 2014.
4. Julia Steele, Noah Ilinsky, “Beautiful Visualization: Looking at Data through the Eyes of Experts”, O’Reilly, 2010.
5. Karl Pover, “Leaning Qlik View Data Visualization”, PACKT, 2013.
6. Stephen Few, “Show Me the Numbers: Designing Tables and Graphs to Enlighten”, Analytics Press, Second Edition, June 2012.

**Course Outcomes:**

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

CO1	Design and create data visualizations.
CO2	Apply data transformations such as aggregation and filtering for visualization.
CO3	Evaluate choice of colour and visual encoding suitable for visualization.
CO4	Build visual presentations of wide variety of data for effective communication.
CO5	Use knowledge of perception and cognition to design information dashboards.

**Outcome Mapping**

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



Semester	23MCAC402:Big Data Analytics	L	P	C
IV		6	0	5

## Course Objectives

- To introduce big data tools & Information Standard formats.
- To understand the basic concepts of big data.
- To learn Hadoop, HDFS and MapReduce concepts.
- To teach the importance of NoSQL.
- To explore the big data tools such as Hive, HBase and Pig.

## UNIT I

**Big Data and Analytics:** Classification of Digital Data: Structured Data- Semi Structured Data and Unstructured Data.

Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop.

Environment Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

## UNIT II

**Technology Landscape:**NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

## UNIT III

**Mongodb and Mapreduce Programming:**MongoDB: Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language.

MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

## UNIT IV

**Hive:** Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having – RCFile - Implementation - Hive User Defined Function - Serialization and Deserialization.

## UNIT V

**Pig:** Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution – Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

**Text Book:**

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, First Edition,2015

**Reference Book:**

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, “Big data for dummies”, John Wiley & Sons, Inc. (2013)
2. Tom White, “Hadoop The Definitive Guide”, O’Reilly Publications, Fourth Edition, 2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, “Hadoop For Dummies”, Wiley Publications, 2014
4. Robert D.Schneider, “Hadoop For Dummies”, John Wiley & Sons, Inc. (2012)
5. Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012 Chuck Lam, “Hadoop In Action”, Dreamtech Publications, 2010

**Course Outcomes**

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

CO1:	To understand, illustrate and evaluate the concepts and techniques of Data Science, Big Data Analytics and its tools	K1-K6
CO2:	To collaborate,apply and review the computing for big data in Hadoop, and NoSQL environment.	K1-K6
CO3:	To comprehend, implement and review the concepts of data science and big data analytics projects using MapReduce, and MongoDB	K1-K6
CO4:	To understand, use and analyze the concepts of big data analytics projects using HIVE database.	K1-K6
CO5:	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	K1-K6

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

**Mapping with Programme Outcomes**

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

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

## List of Elective Courses:

Semester	23MCAE104:Data Engineering and Management	L	P	C
I		5	0	3

### Course Objectives:

- To understand Data Management concepts
- To get brief knowledge on Data Modeling
- To analyse the techniques used in Distributed Databases
- To assess Distributed database and Business Modelling
- To get familiar with CRM tools

### Unit-I

**DATABASE DEVELOPMENT:** Database architecture of an information system-Overview of the database development process-Conceptual data modeling-Relational data analysis-Roles of a data model-Physical database design. **DATA MANAGEMENT:** Problems encountered without data management-Data management responsibilities-Data management activities-Roles within data management-Benefits of data management-Relationship between data management and enterprise

### Unit-II

**CORPORATE DATA MODELLING:** Need for a corporate data model-Nature of a corporate data model- Develop a corporate data model - Corporate data model principles. **DATA DEFINITION AND NAMING:** Elements of a data definition-Data naming conventions. **DATA QUALITY:** Issues associated with poor data quality-Causes of poor data quality-Dimensions of data quality-Data model quality-Improving data quality. **DATA ACCESSIBILITY:** Data security-Data integrity-Data recovery

### Unit-III:

**USE OF PACKAGED APPLICATION SOFTWARE:** Application software packages-Impact on data management. **DISTRIBUTED DATA AND DATABASES:** Rationale for distributing data-Perfect distributed database system-Top down fragmentation and partitioning. Bottom up integration-The management of replication. **BUSINESS INTELLIGENCE:** Data warehousing-Multidimensional model of data-Standard reporting tools-Online analytical processing OLAP-Relational schema for a data warehouse.

### Unit-IV:

**CRM:** Three main pillars of CRM. **GETTING TO KNOW YOUR CUSTOMER:** 360-degree client view. **UTILIZING ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN YOUR CRM STRATEGY:** Evolution of AI-Current state of AI-Teaming up AI with people-Applying AI to your CRM solution-ethical aspects of AI-An example of AI in CRM processes.

### Unit-V:

**CLOUD VERSUS ON PREMISE VERSUS HYBRID:** Factors influencing vendor selection-Hybrid deployment-what are your options. **CRM DIFFERENTIATORS:** It's not about the feature list; it's about the ecosystem-Fourth industrial revolution and CRM-AI and smart cloud-To cloud



**L - Low, M- Medium, S – Strong**

<b>Semester</b>	<b>23MCAE104:Data Engineering and Management Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>I</b>		<b>0</b>	<b>5</b>	<b>3</b>

**Course Objectives:**

- To acquire basic scripting knowledge in MongoDB
- To learn CRUD Operation on MongoDB database
- To comprehend MongoDB using DbVisualizer
- To be familiar with Zoho CRM features
- To customize your application using Zoho CRM

**Exercises:**

1. Write a script to create a MongoDB database and perform insert operation
2. Write a MongoDB script to perform query operations
3. Write a MongoDB Script to perform update operations
4. Write a MongoDB Script to update documents with aggregation pipeline
5. Write a MongoDB script to delete single and multiple documents
6. Write a MongoDB script to perform string aggregation operations
7. Design a Data Model for MongoDB using DbVisualizer
8. Perform CRUD operations using DbVisualizer
9. Create a Zoho CRM account and organize your Tasks, Meetings and Deals
10. Create and maintain a project using Zoho CRM features

**Course Outcomes**

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

Course Outcome	Description	Knowledge Level
<b>CO1</b>	Comprehend the scripting knowledge in MongoDB and perform basic operations in shell prompt	<b>K1- K6</b>
<b>CO2</b>	Implement, Create, Read, Update and Delete Operations on MongoDB database	
<b>CO3</b>	Analyze MongoDB using DbVisualizer	
<b>CO4</b>	Assess Zoho CRM features for managing the customer relationships	
<b>CO5</b>	Create a customized application in Zoho CRM	

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

### Mapping with Programme Outcomes

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

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

Semester	23MCAE104:High Performance Computing	L	P	C
I		5	0	3

### Course Objectives:

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

### Unit-I

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

### Unit-II

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

### Unit-III

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

### Unit-IV

**Efficient OpenMP programming:** Profiling OpenMP programs-Performance pitfalls-Parallel sparse matrix-vector multiply. **Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA-ccNUMA optimization of sparse MVM-Placement pitfalls-ccNUMA issues with C++.

### Unit-V

**Distributed-memory parallel programming with MPI:** Message passing-A short introduction to MPI-MPI parallelization of a Jacobi solver. **Efficient MPI programming:** MPI performance tools-Communication parameters-Synchronization, serialization, contention-Reducing communication overhead-Understanding intranode point-to-point communication.

### Text book:

1. Georg Hager, Gerhard Wellein “Introduction to High Performance Computing for Scientists and Engineers”, CRC Press, 2011.**Chapters:** 1 to 10.

**Reference books:**

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

**Course Outcome:**

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

CO1	Understand of the HPC and ccNUMA concepts	K1 - K6
CO2	Design and develop a parallel programming with modern C, C++ and new version of FORTRAN	
CO3	Apply with parallel computing	
CO4	Develop an efficient OpenMP programming	
CO5	Evaluate an efficient MPI programming	

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

**Mapping with Programme Outcomes:**

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

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



Semester	23MCAE104:High Performance Computing Lab	L	P	C
I		0	5	3

### Course Objectives:

- To understand concepts of High Performance Computing.
- To get brief knowledge about PB and Slurm.
- To understand techniques of OpenMP and OpenMPI.
- To understand Parallel computing concepts.
- To get familiar with CUDA.

(Implemented either PB, Slurm, OpenMP, OpenMPI, and CUDA)

1. Demo: - Access and best practices on HPC
2. Matrix multiplication with Job scheduling (PB or Slurm)
3. Vectors add with malloc shared
4. Vector add program with MPI
5. Hello world task for Multithreading with openMP
6. openMP shared memory on Host and Device
7. openMP Matrix Multiplication with parallelism and Barrier
8. openMP with Reduction on operands and aggregate functionality
9. Vector and Matrix multiplication on CUDA
10. Feed forward computing on CUDA

Semester	23MCAE105:Dot Net Technologies	L	P	C
I		5	0	3

### Course Objectives:

- To get strong understanding of .NET Framework and C# programming.
- To get advanced programming skills in Visual Studio with C# language.
- 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 .NET Technologies.
- To get clear understanding and get experience in Microsoft Azure.

### Unit-I

Introducing C#: .NET Framework - C# language - Visual Studio 2017 - Writing a C# Program: Visual Studio 2017 Development Environment - Console Applications - Desktop Applications - Variables and Expressions: Basic C# Syntax - Basic C# Console Application Structure - Variables - Expressions - Flow Control: Boolean Logic – Branching - Looping.

### Unit-II

More About Variables: Type Conversion - Complex Variable Types - String Manipulation – Functions: Defining and Using Functions - Variable Scope - The Main Function - Struct Functions - Overloading Functions - Using Delegates - Debugging and Error Handling: Debugging in Visual Studio - Error Handling - Introduction to Object Oriented Programming: Object-Oriented Programming - OOP Techniques - OOP in Desktop Applications.

### Unit-III

Defining Classes: Class Definitions in C# - System.Object - Constructors and Destructors - OOP Tools in Visual Studio - Class Library Projects - Interfaces Versus Abstract Classes - Struct Types - Shallow Copying Versus Deep Copying - Defining Class Members: Member Definitions - Additional Class Member Topics - Interface Implementation - Partial Class Definitions - Partial Method Definitions - The Call Hierarchy Window - Basic Cloud Programming: Cloud, Cloud Computing, and the Cloud Optimized Stack - Cloud Patterns and Best Practices - Using Microsoft Azure C# Libraries to Create a Storage Container - Creating an ASP.NET 4.7 Web Site That Uses the Storage Container - Advanced Cloud Programming and Deployment: Creating an ASP.NET Web API - Deploying and Consuming an ASP.NET Web API on Microsoft Azure - Scaling an ASP.NET Web API on Microsoft Azure.

### Unit-IV

.NET Standard and .NET Core: Cross-Platform Basics and Must Know Terms – Need of .NET - Referencing and Targeting Frameworks - .NET Core - Building and Packaging a .NET Standard Library - Building a .NET Core Application with Visual Studio - Porting from .NET Framework to .NET Core - ASP.NET and ASP.NET Core: Overview of Web Applications – Use of ASP.NET - ASP.NET Web Forms - Creating ASP.NET Core Web Applications – Files: File

Classes for Input and Output – Streams - Monitoring the File System - XML and JSON: XML Basics - JSON Basics - XML Schemas - XML Document Object Model - Converting XML to JSON - Searching XML with XPath.

### Unit-V

LINQ: LINQ to XML - LINQ Providers - LINQ Query Syntax - LINQ Method Syntax - Ordering Query Results - Understanding the orderby Clause - Querying a Large Data Set -Using Aggregate Operators - Using the Select Distinct Query - Ordering by Multiple Levels -Using Group Queries - Using Joins – Databases: Using Databases - Installing SQL Server - Express - Entity Framework - Code First Database - Finding the Database - Navigating Database Relationships - Handling Migrations - Creating and Querying XML from an Existing Database - Universal Apps: Windows Universal Apps - App Concepts and Design - App Development - Common Elements of Windows Store Apps - Windows Store.

### Text book:

1. Benjamin Perkins, Jacob Vibe Hammer, Jon D. Reid, “Beginning C#7 Programming with Visual Studio 2017”, Wiley Publishing, 2018.Chapters: 1 to 10, 16 to 23, and 25.

### Reference books:

1. Nagel, Christian, “Professional C 7 and .NET Core 2.0 ”, Wrox Publishing, 2018.
2. Mehboob Ahmed Khan, Ovais, “C# 7 and .NET Core 2.0 High Performance”, Packt Publishing, 2018

### Course Outcome:

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

CO1	Understand and learn .NET Framework and C# .NET	K1, K2	LO
CO2	Apply the concepts to develop the applications for real-time problem in C# .NET and ASP .NET	K3	IO
CO3	Analyze the feasibility of using .NET for real time problems	K4,K5	HO

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

**Mapping with Programme Outcomes:**

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

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

Semester	23MCAE105:Dot Net Technologies Lab	L	P	C
I		0	5	3

### 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.

Implement the following problems using C# with Visual Studio 2017

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:

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

CO1	Get a strong understanding of .NET Visual Studio platform	K1, K2	LO
CO2	Become a strong knowledge in C# .NET	K3	IO
CO3	Getting real-time application developing using .NET Cloud Technologies.	K4,K5	HO

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

**Mapping with Programme Outcomes:**

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

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

Semester	23MCAE105:Architecture and Frameworks	L	P	C
I		5	0	3

## Course Objectives

- To understand the basics, benefits and purpose of software architecture
- Understand the quality attributes to fulfill the software requirements and relates the software with an organization
- Explore the design patterns, best practice and paradigms of efficient software development
- Understand the performance and security measures of software architecture
- Enable the developers to advance their carrier in software domain

### Unit – I

Software architecture introduction – Importance of Software architecture –Software architecture consumers – Architect role - software architecture in an organization – Types of software architects – Software development methodologies – Project management – Office politics – Software risk management – Configuration management – Software product lines

### Unit – II

Domain Knowledge – Developing business acumen – Domain-driven design – requirement engineering – requirement elicitation –Software Quality attributes: Maintainability – Usability – Availability – Portability – Interoperability - Testability

### Unit – III

Software Architectures design – Importance - Top-down Versus bottom-up design approaches – Architectural drivers – Documenting the Software architecture design – Systematic approach - Attribute-driven design – Microsoft’s technique for architecture and design –Architecture-centric design method – Architecture development method – Tracking the progress of the software architecture’s design.

### Unit – IV

Designing orthogonal software systems – Minimizing complexity – SOLID design principles – Software architecture patterns – layered – Event-driven architecture – Model-View patterns – Service-oriented architecture

## Unit – V

Architecting Modern Applications.- Importance of Performance – Performance improvement - Server side caching – Web application performance – Database performance -Securing software systems – Threat modelling – Secure by design

### Text Book

1. Joseph Ingeno, “Software Architect’s Handbook” Packt Publishing 2018.

### Reference books

1. Oliver Vogel, Indo Arnold, ArifChughtaiandTimoKehrer, “Software Architecture” Springer-Verlag, 2011.
2. Ian Gorton, “Essential Software architecture”, Second Edition, Springer, 2011
3. Len Bass, Paul Clements and Rick Kazman, “Software architecture in practice”, Third edition, Addison-Wesley, 2013

### Course Outcomes

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

CO1	Understand, analyze and evaluate the purpose of Software architecture and development methodologies with consideration of risk management	K1-K6
CO2	Comprehend, apply and evaluate the domain knowledge for software development process and determine the impact of quality attributes.	K1-K6
CO3	Understand, track and examine the systematic approach for various software design models with effective document process	K1-K6
CO4	Illustrate and summarize the functions of orthogonal systems with complexity, design principles and design pattern for software architecture	K1-K6
CO5	Comprehend, analyze and evaluate the performance and security measures for Server, Web and Database applications in order to create the secure software systems for various domain applications	K1-K6

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

### Mapping with Programme Outcome

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

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



Semester	23MCAE105:Architecture and Frameworks - Lab	L	P	C
I		0	5	3

### Course Objectives

- To understand and implement the basic concepts of Software architecture and its functions.
- To acquire programming skills to develop Implement various technologies and services associated with network protocols along with the challenges of data transfer.
- Implement the importance and functioning of Routing Protocols over communication service.
- To acquire skills to connect two routers and any two switches.
- To comprehend related to SSH protocols and accessing the remote device.

Note: Use the solid servers and client specification for implementation

<https://github.com/solid/specification/>.

Implement the following using Linux / Windows environments

1. Find the WebID profile document and display the necessary attributes
2. Set and access the primary authentications with account recovery mechanisms
3. Set and access the secondary authentications with account recovery mechanisms
4. Design authorization and web access control
5. Find the content representation
6. Reading resources from HTTP REST API and WebSockets API
7. Writing resources from HTTP REST API and WebSockets API
8. Data notification using Social Web App protocol
9. Managing subscriptions and friends list using Social Web App protocol
10. Managing list of followers and following list using Social Web App protocol

## Course Outcomes

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

CO1	Comprehend the programming skills of Software architecture tools and packages	K1-K6
CO2	Understand and implement the user profiles and authentication with recovery mechanism.	K1-K6
CO3	Comprehend and evaluate the access control and content representation use of FTP server	K1-K6
CO4	Understand and implement reading and writing resources for various applications	K1-K6
CO5	Identify and examine the notifications, friends, and follower list of social application protocols.	K1-K6

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

## Mapping Course outcomes with Programme outcomes

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

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

Semester	23MCAE204: Cryptography and Network Security	L	P	C
II		4	0	3

## Course Objectives

- To familiarize classical encryption techniques and advanced encryption standards
- To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms
- To recognize different encryption and decryption techniques to solve problems related to confidentiality and authentication
- To develop the ability to use existing cryptographic utilities to build programs for secure communication.
- To learn the need of digital signatures to secure the document with key management

### Unit-I

Overview: Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services – Security Mechanisms – A Model for Network Security – Classical Encryption Techniques: Symmetric Cipher Model  
– Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography.

### Unit-II

Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure – The Data Encryption Standard – The DES Example – The Strength of DES – Block Cipher Design Principles – Basic Concepts in Number Theory and Finite Fields: Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic – Groups, Rings, and Fields – Finite Fields of the Form  $GF(p)$  – Polynomial Arithmetic.

### Unit-III

Advanced Encryption Standard: Finite Field Arithmetic – AES Structure – AES Transformation Functions – AES Key Expansion – Block Cipher Operation: Multiple Encryption and Triple DES – Stream Ciphers – RC4 – Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems – The RSA Algorithm – Diffie-Hellman Key Exchange – Elgamal Cryptographic System – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudorandom Number Generation Based on an Asymmetric Cipher.

### Unit-IV

Cryptographic Hash Functions: Applications of Cryptographic Hash Functions  
– Two Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm (SHA) – SHA-3 – Message Authentication Codes: Requirements – Functions – Security of MACs – MACs Based on Hash Functions: HMAC – MACs based on Block Ciphers: DAA and CMAC – Authenticated Encryption: CCM and GCM – Key Wrapping.

### Unit-V

Digital Signatures – Elgamal Digital Signature Scheme – Schnorr Digital Signature Scheme – NIST Digital Signature Algorithm – Elliptic Curve Digital Signature Algorithm – RSA-PSS Digital Signature Algorithm – Key Management and Distribution: Symmetric Key Distribution

Using Symmetric Encryption – Symmetric Key Distribution Using Asymmetric Encryption – Distribution of Public Keys – X.509 Certificates – Public-Key Infrastructure.

**Text Books:**

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education / PHI, 7th Edition.
2. Behrouz A Forouzan, DebdeepMukhopadhyay, “Cryptography And Network Security”, McGraw Hill Education, 3rd Edition.

**Reference Books:**

1. Bernard Menezes, “Network Security and Cryptography”, Cengage, 1st Edition, 2010.
2. William Stallings, “Cryptography and Network Security”, Pearson Education India, Sixth Edition, 2016.
3. V.K. Jain, “Cryptography and Network Security”, Khanna Book Publishing, New Delhi, 2016.
4. C.K. Shyamala, N. Harini, Dr. T. R. Padmanabhan, “Cryptography and Security”, Wiley India Pvt. Ltd., 2011

**Course Outcomes:**

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

CO1:	Comprehend and analyze the security concepts to apply and evaluate the encryption techniques in various models	K1-K6
CO2:	Understand and examine the various data encryption standards and number theory. Illustrate and evaluate the various techniques in different applications	K1-K6
CO3:	Grasp the knowledge of AES techniques and apply to evaluate the performance with different key types	K1-K6
CO4:	Comprehend and analyse the basics of hash function and MAC that helps to develop the encryption models in various application	K1-K6
CO5:	Understand and illustrate the need of digital signature to examine the method of providing good security to the document. And also learn the concept of key management	K1-K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create**

**Mapping with Programme Outcomes:**

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

**S – Strong, M – Medium, L - Low**

<b>Semester</b>	<b>23MCAE204:Cryptography and Network Security Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>0</b>	<b>4</b>	<b>3</b>

### **Course Objective**

- To develop in classical encryption techniques and advanced encryption standards.
- To acquire programming skills in Implement various cryptographic algorithms including secret key cryptography.
- To develop hashes, message digests and public key algorithms.
- Implement different encryption and decryption techniques.
- To comprehend related to confidentiality and authentication techniques.

### **Implement the following**

1. Write a program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in the string with 0 and display the result
2. Write a program to perform encryption and decryption using the Ceaser Cipher
3. Write a program to perform encryption and decryption using the Hill Cipher
4. Write a program to perform encryption and decryption using the Substitution Cipher
5. Write a program to perform encryption and decryption using the DES algorithm
6. Connect to switch with a computer and enable the port security
7. Defeating malware using Building Trojans and Rootkit hunter
8. Implement signature scheme – Digital Signature Standard
9. Identify and capture the user name and password in a same network using wireshark
10. Implement Man-in-the-middle attack and Session hijacking

## Course Outcomes

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

CO1	Comprehend the programming skills in classical encryption techniques and to develop advanced encryption standards	K1-K6
CO2	Understand and implement the various cryptographic algorithms including secret key cryptography, hashes and message digests	K1-K6
CO3	Evaluate the use of different encryption and decryption techniques	K1-K6
CO4	Design to solve related confidentiality and authentication problems	K1-K6
CO5	Create public key algorithms	K1-K6

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

## Mapping Course outcomes with Programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	S	-	-	-	-	L	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S
CO4	S	-	S	-	S	L	-	-	-	S
CO5	S	-	S	-	S	L	-	-	-	S

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

Semester	23MCAE204:Network Protocols	L	P	C
II		4	0	3

### Course Objectives

- To understand the basic concepts of Transmission Control Protocol/Internet Protocol and associated functions
- Explore to describe the internet architecture and its processes associated with the data transfer and to provide the quality of service
- To understand technologies and services associated with network protocols along along with the challenges of dat transfer.
- Learners will understand the importance and functioning of Routing Protocols over communication service.
- Empower the learners to comprehend and manage the issues associated with IP protocols like data traffic problems, security and mobility.

### Unit I

Transmission Control Protocol/Internet Protocol : Fundamental Architecture - Internet Protocol Basics - Routing - Transport-Layer Protocols : Transmission Control Protocol - User Datagram Protocol - Stream Control Transmission Protocol - Real-Time Transport Protocol.

### Unit II

Internet Architecture: Internet Exchange Point - History of Internet Exchange Points - Internet Service Provider Interconnection Relationships - Peering and Transit - IP Routing Protocols: Overview of Routing Protocols - Routing Information Protocol - Open Shortest Path First - Border Gateway Protocol - Multiprotocol Label Switching.

### Unit III

IP Quality Of Service : Introduction - Quality of Service in IP Version 4 - Integrated Services - Differentiated Services - Quality of Service with Nested Differentiated Services Levels - IP Multicast and Anycast: Addressing - Multicast Routing - Routing Protocols –Anycasting- IPv6 Anycast Routing Protocol: Protocol Independent Anycast—Sparse Mode - Transport over Packet: Draft-Martini Signaling and Encapsulation - Layer-2 Tunneling Protocol.

### Unit IV

Virtual Private Wired Service - Types of Private Wire Services - Generic Routing Encapsulation - Layer-2 Tunneling Protocol - Layer-3 Virtual Private Network 2547bis, Virtual Router - IP and Optical Networking: IP/Optical Network Evolution - Challenges in Legacy Traditional IP/Optical Networks - Automated Provisioning in IP/Optical Networks - Control Plane Models for IP/Optical Networking - Next-Generation MultiLayer Network Design Requirements - Benefits and Challenges in IP/Optical Networking - IP Version 6: Addresses in IP Version 6 - IP Packet Headers - IP Address Resolution - IP Version 6 Deployment: Drivers and Impediments.



## Unit V

IP Traffic Engineering: Models of Traffic Demands - Optimal Routing with Multiprotocol Label Switching - Link-Weight Optimization with Open Shortest Path First - Extended Shortest-Path-Based Routing Schemes - IP Network Security: Introduction - Detection of Denial-of-Service Attack - IP Trace back- Edge Sampling Scheme - Advanced Marking Scheme - Mobility Support for IP: Mobility Management Approaches - Security Threats Related to IP Mobility - Mobility Support in IPv6 - Reactive Versus Proactive Mobility Support - Relation to Multihoming - Protocols Supplementing.

### Text Book :

1. “Advanced Internet Protocols, Services and Applications”, Eiji Oki, Roberto Rojas-Cessa, Mallikarjun Tatipamula, Christian Vogt, Copyright © 2012 by John Wiley & Sons, Inc.

### Reference Books:

1. “TCP/IP Protocol Suite”, Behrouz A. Forouzan, Fourth Edition, Tata Mcgraw-Hill Edition 2010.
2. “Computer Communications and Networking Technologies” - Michael A. Gallo & William M. Hancock- BROOKS&COLE
3. “Computer Networks and Internets” -Douglas E. Comer- PEARSON.
4. Data and Computer Communications- Eighth Edition- William Stallings- Pearson Education.
5. Network Security Bible, 2nd edition, Eric Cole, Wiley Publishers.
6. Data communication and networks –James Irvine and David Harley- Publishers: Wiley India

### Course Outcomes:

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

CO1	Understand, analyse and examine the concepts of Communication Protocols with its architecture and functions	K1- K6
CO2	Illustrate and apply the appropriate internet architecture along with efficient protocol models for the user defined communication environment	K1- K6
CO3	Comprehend, categorize and formulate the appropriate IP routing protocol to establish a efficient data transfer	K1- K6
CO4	Comprehend, analyse and evaluate the concepts of Virtual wired service and IP/optical networking with its functions and deployment	K1- K6
CO5	Elucidate, analyse and inspect the IP traffic engineering and its models along with the security mechanisms	K1- K6

**K1- Remember, K2- Understand, K3- Apply , K4- Analyze, K5- evaluate and K6- Create**

## Mapping with Programme Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
CO1	M	S	-	L	M	S	M	M	-	S
CO2	S	M	-	S	M	L	M	S	-	M
CO3	S	S	-	M	S	S	S	M	-	S
CO4	S	M	L	S	M	L	S	L	-	M
CO5	M	S	M	L	S	L	M	S	-	S

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

<b>Semester</b>	<b>23MCAE104:Network Protocols Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>0</b>	<b>4</b>	<b>3</b>

### Course Objectives

- To understand and implement the basic concepts of Transmission Control Protocol/Internet Protocol and associated functions.
- To acquire programming skills in Implement various technologies and services associated with network protocols along with the challenges of data transfer.
- Implement the importance and functioning of Routing Protocols over communication service.
- To acquire skills to connect two routers and any two switches.
- To comprehend related to SSH protocols and accessing the remote device.

### Implement the following using Linux / Windows environments

2. Implement the following commands
  - a. ipconfig
  - b. ping
  - c. traceroute
  - d. netsat
  - e. nslookup
  
3. Implement the following server commands
  - a. ifconfig
  - b. ip
  - c. tracepath
  - d. ss
  - e. tcpdump
  
4. Connect and place the given file in the FTP server
5. Install packet tracer and connect a computer to router, switch and get a Icmp request
6. Implement the SSH protocols and accessing the remote device
7. Connect any two switches and get the status of each switches
8. Connect two routers and get packets from the routers.
9. Get the access of the router by connecting with working computer
10. Identify the route password of server and get the connection using telnet
11. Install wire shark for capture and analyse the packets (TCP /UDP)

## Course Outcomes

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

CO1:	Comprehend the programming skills the SSH protocols and accessing the remote device	K1-K6
CO2:	Understand and implement the various functioning of Routing Protocols over communication service.	K1-K6
CO3:	Evaluate the use of FTP server	K1-K6
CO4:	Design to Connect any two switches and get the status of each switches	K1-K6
CO5:	Solve to Connect two routers and get packets from the routers.	K1-K6

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

## Mapping Course outcomes with Programme outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
CO1	S	-	-	-	-	L	-	-	-	-
CO2	S	-	M	-	M	L	-	-	-	-
CO3	S	-	S	-	S	L	-	-	-	S
CO4	S	-	S	-	S	L	-	-	-	S
CO5	S	-	S	-	S	L	-	-	-	S

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

<b>Semester</b>	<b>23MCAE205:Computer Vision</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>4</b>	<b>0</b>	<b>3</b>

### Course Objectives:

- To get understanding about Computer vision techniques behind a wide variety of real-world applications.
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to build a computer vision application with Python language.
- To understand various machine learning techniques that are used in computer vision tasks.
- To incorporate machine learning techniques with computer vision systems.

### Unit-I

**Basic Image Handling and Processing:** PIL – the Python Imaging Library-Matplotlib-NumPy-SciPy-Advanced example: Image de-noising. **Local Image Descriptors:** Harris corner detector-SIFT - Scale-Invariant Feature Transform-Matching Geotagged Images.

### Unit-II

**Image to Image Mappings:**Homographies-Warping images-Creating Panoramas. **Camera Models and Augmented Reality:** The Pin-hole Camera Model-Camera Calibration-Pose Estimation from Planes and Markers-Augmented Reality.

### Unit-III

**Multiple View Geometry:**Epipolar Geometry-Computing with Cameras and 3D Structure-Multiple View Reconstruction-Stereo Images. **Clustering Images:** K-means Clustering-Hierarchical Clustering-Spectral Clustering.

### Unit-IV

**Searching Images:** Content based Image Retrieval-Visual Words-Indexing Images- Searching the Database for Images-Ranking Results using Geometry-Building Demos and Web Applications. **Classifying Image Content:** K-Nearest Neighbors-Bayes Classifier-Support Vector Machines-Optical Character Recognition.

### Unit-V

**Image Segmentation:** Graph Cuts-Segmentation using Clustering-Variational Methods. **OpenCV:** Python Interface-OpenCV Basics-Processing Video-Tracking.

### Course Outcome:

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

CO1	To understand and recall computer vision and its application areas	K1-K6
CO2	To develop build a computer vision system	
CO3	To apply and analyze a design range of algorithms for image processing and computer vision	
CO4	To develop incorporate machine learning techniques with computer vision system	
CO5	To apply and analyze image segmentation and image registration	

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

**Mapping with Programme Outcomes:**

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

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

<b>Semester</b>	<b>23MCAE205:Computer Vision Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>0</b>	<b>4</b>	<b>3</b>

**Course Objectives:**

- To get an idea of how to build a computer vision application with Python language.
- To learn the basic image handling and processing
- To get familiar with various Computer Vision fundamental algorithms and how to implement and apply.
- To get an idea of how to implement the image transforms.
- To understand various image segmentation algorithms.

Implement the following problems using Python with OpenCV

1. Image Loading, Exploring, and displaying an Image.
2. Access and Manipulate of Image Pixels.
3. Image Transformations.
  - i) Resizing
  - ii) Rotation
4. Addition operation of Two Images.
5. Image filtering operations
  - i) Mean Filtering
  - ii) Gaussian Filtering
6. Image Binarization Using Simple Thresholding method.
7. Edge Detection operation using Sobel and Scharr Gradients.
8. Find Grayscale and RGB Histograms of an Image.
9. Segment an Image using K-means Clustering algorithm.
10. Write a program to classify an Image using KNN Classification algorithm.

**Course Outcome:**

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

CO1	To develop and implement the image loading and exploring	K1-K6
CO2	To Evaluate the image transforms	
CO3	To apply and analyze for image processing denoising algorithms	
CO4	To design and develop the Image Segmentation using Edge detection and	
CO5	To apply and analyze image clustering and classification algorithms	

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

**Mapping with Programme Outcomes:**

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

L - Low, M- Medium, S - Strong



<b>Semester</b>	<b>23MCAE205:Solution Architecture</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>4</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- To get familiar with the evolution of solution architecture
- To outline the functionalities of Solution Architecture Design
- To assess the Performance Considerations of Solution Architecture
- To analyze the Architectural Reliability Considerations
- To identify the design principles for cost optimization

**UNIT I**

Evolution of solution architecture - The benefits of solution architecture - Solution architecture in the public cloud - Solution Architects in an Organization - Types of solution architect role - Understanding a solution architect's responsibilities - Attributes of the Solution Architecture - Scalability and elasticity - Security and compliance - Cost optimization and budget

**UNIT II**

Principles of Solution Architecture Design - Scaling workload - Building resilient architecture - Design for performance - Using replaceable resources - Cloud Migration and Hybrid Cloud Architecture Design - Benefits of cloud-native architecture - Creating a cloud migration strategy - Steps for cloud migration - Creating a hybrid cloud architecture - Designing a cloud-native architecture

**UNIT III**

Solution Architecture Design Patterns - Building an n-tier layered architecture - Creating multi-tenant SaaS-based architecture - Building stateless and stateful architecture designs - Understanding SOA - Performance Considerations - Design principles for architecture performance - Technology selection for performance optimization - Managing performance monitoring

**UNIT IV**

Architectural Reliability Considerations - Design principles for architectural reliability - Technology selection for architecture reliability - Improving reliability with the cloud - Operational Excellence Considerations - Designing principles for operational excellence - Selecting technologies for operational excellence - Achieving operational excellence in the public cloud

## UNIT V

Cost Considerations - Design principles for cost optimization - Techniques for cost optimization - Cost optimization in the public cloud - Architecting Legacy Systems - Learning the challenges of legacy systems - Defining a strategy for system modernization - Looking at legacy system modernization techniques - Defining a cloud migration strategy for legacy systems

### Text Books:

1. Saurabh Shrivastava and Neelanjali Srivastav, “ Solutions Architect's Handbook”, Packt Publishing, 2020

### Reference Books:

1. Alan McSweeney , “Introduction to Solution Architecture”, Kindle Edition, 2019
2. Bernard, Scott A. An introduction to holistic enterprise architecture. Author House, 2020.

### Course Outcomes

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

<b>CO1</b>	Comprehend the types, benefits and attributes of solution architecture	<b>K1- K6</b>
<b>CO2</b>	Assess the cloud architecture and create hybrid cloud architecture	
<b>CO3</b>	Analyze the design patterns for solution architecture	
<b>CO4</b>	Understand Architecture Reliability and Operational Excellence	
<b>CO5</b>	Optimize the cost in cloud and assess the legacy system	

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

### Mapping with Programme Outcomes

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

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

<b>Semester</b>	<b>23MCAE205:Solution Architecture Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>II</b>		<b>0</b>	<b>4</b>	<b>3</b>

### Course Objectives:

- To get familiar with AWS cloud services
  - To design secure, scalable, and well structured cloud solutions
  - To create EC2 instance and configure options
  - To connect EC2 with Linux instance
  - To connect VPN server to securely access instances
1. Managing Virtual Private Cloud
  2. Creating and Configuring Internet Gateways
  3. Configuring Routing Tables
  4. Working with Amazon Elastic Cloud Compute (EC2)
  5. Connecting EC2 Linux instance using PuTTY, Gitbash and Console
  6. Recovering and connecting EC2 instance if the SSH key is lost
  7. Creating and Configuring Elastic Load Balancer
  8. Scheduling Auto Snapshot of volumes
  9. Configuring Centralized Log Management using CloudWatch Log
  10. Connecting OpenVPN server

### Course Outcomes

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

<b>CO1:</b>	Understand AWS cloud services and manage the cloud data	<b>K1- K6</b>
<b>CO2:</b>	Develop secure, scalable, and well structured cloud solutions	
<b>CO3:</b>	Implement EC2 instance and configure the instance	
<b>CO4:</b>	Connect EC2 with Linux instance and perform operations	
<b>CO5:</b>	To connect VPN server to access instances with more security	

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

### Mapping with Programme Outcomes

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

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

Semester	23MCAE305:Mobile Computing	L	P	C
III		3	0	3

Course Objective:

- To introduce the concepts of wireless devices with signal, Antenna, Radio Frequencies, Signal Propagation.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, Wireless LAN, GSM, CDMA.
- To introduce the WAP Architecture, MANET and Routing

### Unit-I

Introduction – Applications – History of wireless communication – A Simplified reference model - Wireless transmission – Frequencies for radio transmission – Regulations – Signals – Antennas - Signal propagation: Path loss of radio signals - Additional signal propagation effects - Multi-path propagation – Multiplexing –Modulation Chapters: 1, 2.1 to 2.6

### Unit-II

Spread spectrum – Direct sequence spread spectrum – Frequency hopping spread spectrum – Cellular systems. Medium access control: Hidden and exposed terminals – Near and far terminals – SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, slotted Aloha, Carrier sense multiple access – Reservation TDMA – Multiple access with collision avoidance – Polling – CDMA – Spread Aloha multiple access. Chapters: 3.1 to 3.3, 3.4.1 to 3.4.4, 3.4.7 to 3.4.9, 3.5.1

### Unit-III

GSM - Mobile services – System architecture – Radio interface – Protocols – Localization and calling – Handover – Security – New Data services. UMTS and IMT-2000 - Satellite Systems: Applications – Basics – Routing – Localization – Handover.Chapters: 3.6, 4.1.1 to 4.1.8, 4.4, 5.2 to 5.6

### Unit-IV

Wireless LAN: Infra red vs. radio transmission – Infrastructure and ad-hoc network – IEEE 802.11 – System architecture – Protocol architecture – Physics layer – Medium access control layer – MAC management – Blue tooth. Mobile network layer: Mobile IP: Goals, assumptions and requirements – entities and terminology – packet delivery – Agent discovery – Registration – Tunneling and encapsulation Recent technologies Chapters: 7.1 to 7.3.5, 7.5, 8.1.1 to 8.1.6

### Unit-V

WAP: Architecture – wireless datagram Protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Mobile ad-hoc networks – MANET Characteristics – Classification of MANETs, Routing of MANETs, Proactive Routing Protocol - DSDV, Reactive Routing Protocols – DSR, AODV.Chapter10.3.1 to 10.3.6 (Text Book 2- 6.1, 6.2, 6.4, 6.5, 6.6)

Course Outcomes:

**Text Book:**

1. Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2013.
2. KumKumGarg, “Mobile Computing Theory and Practice”, Pearson Education, 2014.

**Reference Books:**

1. Rifaat A. Dayen, “Mobile Data & Wireless LAN Technologies”, Prentice Hall, 1997.
2. Steve Mann and Scoot Schibli, “The Wireless Application Protocol”, John Wiley & Inc., 2000.

**Course Outcomes:**

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

CO1	Understanding the basic concepts of Mobile and Wireless Communication	K1, K2	LO
CO2	Understanding the basic concepts of Spread Spectrum. Analyzing the concepts of Medium Access Control.	K3	IO
CO3	Analyzing the concepts of Global System for Mobile Communication and Satellite Communications. Understanding the basic concepts of Wireless LAN	K4	HO
CO4	Understanding the basic concepts of Wireless LAN. Evaluate the performance of Mobile Network Layer	K2, K5	HO
CO5	Understanding the basic concepts of Wireless Application Protocol and create a MoileApp with real time application. Analyzing the concepts of Routing Protocols in MANET	K2, K4, K6	HO

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

**Mapping Course outcomes with Programme outcomes:**

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

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

Semester	23MCAE305:Mobile Computing Application Development Lab	L	P	C
III		0	3	3

### Course Objective

- To enable the students practice the concepts of Mobile application and develop solutions for real world problems.
- Understand how to work with various mobile application development frameworks.
- Comprehend the capabilities and limitations of mobile devices.
- To get clear understanding of mobile application development with WML/J2ME.
- To get advanced methods for mobile application that makes use of any database.

### List of programs

1. Implement the WML tags and Image using WML/J2ME.
2. Design of simple Calculator having +, -, \* and / using WML/J2ME.
3. Design of Calendar for any given month and year using WML/J2ME.
4. Design a Timer to System Time using WML/J2ME.
5. Design of a simple game using WML/J2ME.
6. Animate an image using WML/J2ME.
7. Design a personal phone book containing the name, phone no., address, e-mail, etc
8. Browsing the Internet using a Mobile phone simulator.
9. Develop a Mobile application to view the live streaming using video view.
10. Develop a mobile application that makes use of any database.

### Course Outcomes

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

CO1:	Apply the knowledge of mobile application development with WML/J2ME.	K1-K6
CO2:	Design real life situational problems and think creatively about solutions of them.	K1-K6
CO3:	Appraise the best features Programs for creating dynamic and interactive web pages using forms.	K1-K6
CO4	Create a Mobile application to view the live streaming using video view.	K1-K6
CO5	Create a mobile application that makes use of any database.	K1-K6

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

### Mapping Course outcomes with Programme outcomes

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

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



<b>Semester</b>	<b>23MCAE305:Optimization Techniques</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>3</b>	<b>0</b>	<b>3</b>

### Course Objectives

- To understand the concept of Linear optimization
- To develop mathematical models of transportation and assignment Problems
- To understand the Networking models
- To study non-linear optimization models
- To develop optimization algorithms based on Evolutionary concepts

#### Unit – I : Linear Programming Problem

Linear Programming Problem (LPP): Mathematical Formulation of Linear Programming Problem - Graphical Solution of LPP - canonical and standard forms of linear programming problem- Simplex method for solving LPP

#### Unit – II : Transportation and Assignment Problems

Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. Assignment Model : Hungarian assignment model – Travelling Sales Man Problem.

#### Unit – III : CPM/PERT

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity –PERT Computation – CPM Computation – Resource Scheduling.

#### Unit – IV : Non-Linear Optimization Models

Simplex Method – Gradient of function – Steepest Descent method – Conjugate Gradient method

#### Unit – V : Evolutionary Algorithms

Particle Swarm Optimization method – Ant Colony optimization algorithm – Fruit Fly method – Fire Fly method

### Text Book

1. KantiSwarup, P. K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons, New Delhi, 2014. (Unit 1, 2, and 3)
2. S. S. Rao, Engineering Optimization: Theory and Practice, JOHN WILEY & SONS, INC., 2009. (Unit 4)
3. Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to Clever Algorithms, Springer, 2014.(Unit 5)

### Reference Book

Hamdy A. Taha, Operations Research: An Introduction, Pearson, 2010

**Course outcome:**

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

CO1	Develop Linear Programming models for industrial problems	K1-K6
CO2	Formulation of Transportation and Assignment problems for real life	K1-K6
CO3	Critical path estimation can be done for a project	K1-K6
CO4	Non-Linear optimization models can be solved	K1-K6
CO5	Evolutionary Optimization algorithms can be used to solve any optimization problems to overcome the issues in the traditional optimization models	K1-K6

**Mapping with Programme Outcomes**

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

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

<b>Semester</b>	<b>23MCAE305:Optimization Techniques Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>0</b>	<b>3</b>	<b>3</b>

#### Course Objectives

- To understand the concept of optimization
- To develop mathematical model of real life cases
- To study Optimization algorithms

Implement the following algorithms using Python

1. Simplex algorithm
2. North-West Corner algorithm
3. Least Cost algorithm
4. Vogel's Approximation Algorithm
5. Modi algorithm
6. Hungarian assignment Algorithm
7. Travelling Sales man algorithm
8. Steepest Descent algorithm
9. Conjugate gradient algorithm
10. Ant Colony algorithm

Semester	23MCAE404:Soft Computing	L	P	C
IV		4	0	2

### Course Objectives:

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- To understand supervised and unsupervised learning algorithms
- To enable the students to gain a basic understanding of neural networks.
- To know about fuzzy logic, fuzzy inference systems, and their functions.
- To impart basic knowledge on Genetic algorithms and their applications.

### UNIT-I

**INTRODUCTION TO SOFT COMPUTING:** Artificial Neural Networks- Biological Neurons- Basic Models of Artificial Neural Networks-Connections-Learning-Activation Functions- Important Terminologies of ANNs- Muculloch and Pitts Neuron-Linear Separability-Hebb Network-Flowchart of Training Process-Training Algorithm.

### UNIT - II

**SUPERVISED LEARNING NETWORK :** Perceptron Networks–Perceptron Learning Rule-Architecture-Flowchart for Training Process-Perceptron Training Algorithms for Single Output Classes-Perceptron Training Algorithm for Multiple Output Classes-Perceptron Network Testing Algorithm - Adaptive Linear Neuron-Delta Rule for Single Output Unit-Flowchart for training algorithm-Training Algorithm – Testing Algorithm - Multiple Adaptive Linear Neurons-Architecture-Flowchart of Training Process-Training Algorithm-Back Propagation Network-Architecture-Flowchart for Training Process-Training Algorithm-Learning Factors of Back-Propagation Network-Radial Basis Function Network- Architecture-Flowchart for Training Process-Training Algorithm.

### UNIT-III

**UNSUPERVISED LEARNING NETWORK:** Associative Memory Networks - Auto Associative Memory Network-Architecture-Flowchart for Training Process-Training Algorithm-Testing Algorithm- Bidirectional Associative Memory- Architecture-Discrete Bidirectional Associative Memory-Iterative Auto Associative Memory Networks - Linear AutoAssociative Memory-Kohonen Self-Organizing Feature Map- Architecture-Flowchart for Training Process-Training Algorithm.

### UNIT-IV

**INTRODUCTION TO FUZZY LOGIC:** Classical Sets –Operations on Classical Sets-Fuzzy sets - Fuzzy Sets- Properties of Fuzzy Sets- Fuzzy Relations –Membership Functions: Fuzzification- Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods–Max-Membership Principle-Centroid Method-Weighted Average Method-Mean Max Membership-Center of Sums-Center of Largest

Area-First of Maxima - Fuzzy Set Theory - Fuzzy Arithmetic And Fuzzy Measures: Fuzzy Measures – Belief and Plausibility Measures-Probability Measures-Possibility and Necessity Measures- Formation of Rules –Fuzzy Inference Systems (FIS) – Fuzzy Decision Making – Fuzzy Logic Control Systems.

## **UNIT-V**

**GENETIC ALGORITHM:** Introduction - Biological Background - Traditional Optimization and Search Techniques -Gradient Based Local Optimization Method-Random Search-Stochastic Hill Climbing-Simulated Annealing-Symbolic Artificial Intelligence-Operators in Genetic Algorithm -Encoding-Selection-Crossover-Mutation - Stopping Conditions for Genetic Algorithm Flow-Genetic Programming-Working of Genetic Programming-Characteristics of Genetic Programming-Data Representation.

## **Text Books**

1. Principles of Soft Computing, S.N. Sivanandam, S.N.Deepa, Wiley, Third Edition, 2019.

**UNIT I:** Chapter 1: 2.1,2.3,2.4,2.5,2.6,2.7

**UNIT II:** Chapter 2: 3.2,3.3,3.4,3.5,3.6

**UNIT III:** Chapter 3: 4.3,4.4,4.7,5.3

**UNIT IV:** Chapter 4: 7.2,7.3,8.4,9.3,9.4,10,10.2,10.3,10.4,11.4,12.8,14

**UNIT V:** Chapter 5: 15,15.2,15.3,15.4,15.9,15.10

## **Reference Books**

1. Das, A. (2018). Artificial Intelligence and Soft Computing for Beginners.
2. Amit, K. (2018). Artificial intelligence and soft computing: behavioral and cognitive modeling of the human brain. CRC press.
3. Rajasekaran, S., &Pai, G. V. (2011). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd.
4. Jang, J. S. R., Sun, C. T., &Mizutani, E. (2004). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.
5. Gupta, M. M. (2004). Soft computing and intelligent systems: theory and applications. Elsevier.
6. Jang, J. S. R., Sun, C. T., &Mizutani, E. (1997). Neuro-fuzzy and soft computing-a computational approach to learning and machine intelligence [Book Review]. IEEE Transactions on automatic control, 42(10), 1482-1484.

**Course Outcomes:**

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

<b>CO1</b>	To provide an introduction to the basic principles, techniques, and applications of soft computing	K- 1 K2	LO
<b>CO2</b>	To get familiar with Neural network architectures and supervised learning algorithms	K3	IO
<b>CO3</b>	To understand the architectures and algorithms of Unsupervised Learning techniques	K3- K4	H O
<b>CO4</b>	Develop the skills to gain a basic understanding of fuzzy logic theory and fuzzy inference systems	K4	IO
<b>CO5</b>	Ability to learn traditional optimization and search techniques and genetic programming	K5	H O

**Mapping With Programme Outcomes**

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

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

<b>Semester</b>	<b>23MCAE404:Soft Computing Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>IV</b>		<b>0</b>	<b>4</b>	<b>2</b>

### Course Objectives:

- To implement various Supervised Neural Network-based approaches
- To apply the fuzzy-based logical operations and arithmetic operations
- To implement unsupervised neural network approaches
- To solve a problem using a simple genetic algorithm
- To implement logic gates.

### Program List

1. Implementation of Logic gates using Artificial Neural Network.
2. Implementation of Perception Algorithm.
3. Implementation of Back Propagation Algorithm.
4. Implementation of Self Organizing Maps.
5. Implementation of Radial Basis Function Network.
6. Implementation of De-Morgan's Law.
7. Implementation of McCulloch Pits Artificial Neuron model
8. Implementation of Simple genetic algorithm
9. Implementation of fuzzy based Logical operations
10. Implementation of fuzzy based arithmetic operations

### Course Outcomes:

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

CO1	To apply supervised learning algorithms for real datasets	K- 1K2	LO
CO2	To implement Unsupervised Learning techniques	K3	IO
CO3	To apply fuzzy based arithmetic and logical operations	K3- K4	HO
CO4	To find solutions for problems using Genetic algorithm	K4	IO
CO5	To implement DeMorgan's Law	K5	HO

### Mapping With Programme Outcomes

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

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



<b>Semester</b>	<b>23MCAE404:Internet of Things</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>IV</b>		<b>4</b>	<b>0</b>	<b>3</b>

### **Course Objectives:**

- To get familiar with the evolution of IOT with its design principles
- To outline the functionalities and protocols of internet communication
- To analyze the hardware and software components needed to construct IOT applications
- To identify the appropriate protocol for API construction and writing embedded code
- To realize various business models and ethics in Internet of Things

### **Unit I:**

#### **Fundamentals of IoT**

Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOTWF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack – Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

### **UNIT II**

#### **IoT Protocols**

IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

### **UNIT – III**

#### **Design and Development**

Prototyping Embedded Devices: Electronics - Embedded Computing Basics – Arduino - Raspberry Pi - Beagle Bone Black - Electric Imp. Prototyping the Physical Design: Non digital Methods - Laser Cutting - 3D printing - CNC Milling - Repurposing/Recycling.

### **UNIT – IV**

Prototyping Online Components: Getting started with an API - Writing a New API - Real-Time Reactions - Other Protocols. Techniques for Writing Embedded Code: Memory Management - Performance and Battery Life – Libraries - Debugging.

## UNIT – V

Business Models: History of Business Models – Model – Internet of Starting up – Lean Startups. Moving to Manufacture: Designing Kits - Designing Printed circuit boards – Certification – Costs - Scaling Up Software. Ethics: Privacy – Control – Environment – Solutions.

### Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017 (UNIT I and II)
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014. (UNIT III, IV and V)

### Reference Books:

1. Ovidiu Vermesan and Peter Friess, “Internet of Things – From Research and Innovation to Market Deployment” , River Publishers, 2014.
2. Peter Waher, “Learning Internet of Things” ,Packt Publishing, 2015.
3. Donald Norris, “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBoneBlack”,McGraw Hill, 2015.

### Course Outcomes

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

CO1:	Comprehend the IoT evolution with its architecture and sensors	K1- K6
CO2:	Understand the networking concepts for communication and underlying IoT protocols	
CO3:	Assess the embedded technologies and develop prototypes for the IoT products	
CO4:	Evaluate the use of Application Programming Interface and design an API for IoT in realtime	
CO5:	Recognize the ethics of business models and perform security analysis	

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

### Mapping with Programme Outcomes

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

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

<b>Semester</b>	<b>23MCAE404:Internet of Things Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>IV</b>		<b>0</b>	<b>4</b>	<b>3</b>

**Course Objectives:**

- To create IoT program to turn ON/OFF LED
  - To implement IoT program for object detection
  - To develop IoT programs for agricultural purpose
  - To create web server program for local hosting
  - To design IoT application for health monitoring
1. To develop an IoT program to turn ON/OFF LED light (3.3V)
  2. To develop an IoT program using IR sensor (Smart Garbage Monitoring, Detecting Parking Availability, etc.)
  3. To develop an IoT program using Humidity and Temperature Monitoring (Forest fire Detection, Weather Monitoring)
  4. To develop an IoT web server program for local hosting
  5. To develop an IoT program using Soil Moisture Sensor
  6. To develop an IoT program using Ultrasonic Sensor (Distance Measurement, etc.)
  7. To develop an real-time IoT program using Relay Module (Smart Home Automation with 230V)
  8. To develop an IoT program for Fire Detection (Home, Industry,etc.)
  9. To develop an IoT program for Gas Leakage detection (Home, Industry, etc.)
  10. To develop an IoMT program using Heartbeat Sensor

## Course Outcomes

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

<b>CO1</b>	Implement IoT programs to turn ON/OFF LED	K1 - K6
<b>CO2</b>	Develop IoT programs for object detection	
<b>CO3</b>	Create IoT programs for agricultural purpose	
<b>CO4</b>	Implement web server program for local hosting	
<b>CO5</b>	Design IoT application for health monitoring	

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

## Mapping with Programme Outcomes

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

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

## Skill Enhancement Course [SEC]-I

Semester	23MCAS206:Software Development Technologies	L	P	C
II		4	0	2

### Course Objectives

- To learn and Implementing Micro services
- To analysing the Azure Kubernetes Service
- To learn and anlyse .NET DevOps for Azure and its applications
- To building code for .NET core applications
- To get familiarized with Azure pipelines

### Unit -I

**Implementing Microservices:** Client to microservices communication, Interservice communication, data considerations, security, monitoring, microservices hosting platform options. Azure Service Fabric: Introduction, core concepts, supported programming models, service fabric clusters, develop and deploy applications of service fabric. Monitoring Azure Service Fabric Clusters: Azure application, resource manager template, Adding Application Monitoring to a Stateless Service Using Application Insights, Cluster monitoring, Infrastructure monitoring.

### Unit-II

**Azure Kubernetes Service (AKS):** Introduction to kubernetes and AKS, AKS development tools, Deploy applications on AKS. Monitoring AKS: Monitoring, Azure monitor and analytics, monitoring AKS clusters, native kubernetes dashboard, Prometheus and Grafana. Securing Microservices: Authentication in microservices, Implenting security using API gateway pattern, Creating application using Oclot and securing APIs with Azure AD. Database Design for Microservices: Data stores, monolithic approach, Microservices approach, harnessing cloud computing, database options on MS Azure, overcoming application development challenges. Building Microservices on Azure Stack: Azure stack, Offering IaaS, PaaS on-premises simplified, SaaS on Azure stack.

### Unit-III

**.NET DevOps for Azure:** DevOps introduction, Problem and solution. Professional Grade DevOps Environment: The state of DevOps, professional grade DevOps vision, DevOps architecture, tools for professional DevOps environment, DevOps centered application. Tracking work: Process template, Types of work items, Customizing the process, Working with the process. Tracking code: Number of repositories, Git repository, structure, branching pattern, Azure repos configuration, Git and Azure.

## Unit-IV

**Building the code:** Structure of build, using builds with .NET core and Azure pipelines, Validating the code: Strategy for defect detection, Implementing defect detection. Release candidate creation: Designing release candidate architecture, Azure artifacts workflow for release candidates, Deploying the release: Designing deployment pipeline, Implementing deployment in Azure pipelines. Operating and monitoring release: Principles, Architectures for observability, Jumpstarting observability.

## Unit-V

**Introduction to APIs:** Introduction, API economy, APIs in public sector. API Strategy and Architecture: API Strategy, API value chain, API architecture, API management. API Development: Considerations, Standards, kick-start API development, team orientation. API Gateways: API Gateways in public cloud, Azure API management, AWS API gateway. API Security: Request-based security, Authentication and authorization.

## Text Book

1. Harsh Chawla and Hemant Kathuria, Building Microservices Applications on Microsoft Azure- Designing, Developing, Deploying, and Monitoring, Apress, 2019.
2. Jeffrey Palermo , NET DevOps for Azure A Developer's Guide to DevOps Architecture the Right Way, Apress, 2019.
3. Thurupathan and Vijayakumar, Practical API Architecture and Development with Azure and AWS - Design and Implementation of APIs for the Cloud, Apress, 2018.

## Reference Books

1. Karl Matthias and Sean P. Kane, Docker: Up and Running, O'Reilly Publication, Second Edition 2018.
2. Len Bass,IngoWeber,LimingZhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication, First Ediiton 2015.
3. John Ferguson Smart,"Jenkins, The Definitive Guide", O'Reilly Publication, First Ediiton 2011.

## Course Outcomes

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

CO1:	To understand, apply and summarize the basic concepts of Micro services communication Microsoft Azure and Dev Ops for software development life cycle	K1-K6
CO2:	To illustrate, and implement Azure Kubernetes Service tools for software development life cycle	K1-K6
CO3:	To recognize, analyse and summarize the functionalities of .NET Dev Ops for Azure applications	K1-K6
CO4:	To understand, design and evaluate the principles and architecture service tools for software development life cycle.	K1-K6
CO5:	To comprehend, implement and review the functionalities of API and API gateways for cloud and Azure applications	K1-K6

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

### Mapping with Programme Outcomes

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

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



Semester	23MCAS206:Optimization Techniques	L	P	C
II		4	0	2

### Course Objectives

- To understand the concept of Linear optimization
- To develop mathematical models of transportation and assignment Problems
- To understand the Networking models
- To study non-linear optimization models
- To develop optimization algorithms based on Evolutionary concepts

#### Unit – I : Linear Programming Problem

Linear Programming Problem (LPP): Mathematical Formulation of Linear Programming Problem - Graphical Solution of LPP - canonical and standard forms of linear programming problem- Simplex method for solving LPP

#### Unit – II : Transportation and Assignment Problems

Transportation Model: North West corner Method, Least cost method, and Vogel's Approximation Method. Assignment Model : Hungarian assignment model – Travelling Sales Man Problem.

#### Unit – III : CPM/PERT

Project Scheduling PERT/CPM Networks – Fulkerson's Rule – Measure of Activity –PERT Computation – CPM Computation – Resource Scheduling.

#### Unit – IV : Non-Linear Optimization Models

Simplex Method – Gradient of function – Steepest Descent method – Conjugate Gradient method

#### Unit – V : Evolutionary Algorithms

Particle Swarm Optimization method – Ant Colony optimization algorithm – Fruit Fly method – Fire Fly method

#### Text Books

1. KantiSwarup, P. K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons, New Delhi, 2014. (Unit 1, 2, and 3)
2. S. S. Rao, Engineering Optimization: Theory and Practice, JOHN WILEY & SONS, INC., 2009. (Unit 4)
3. Bo Xing and Wen-Jing Gao, Innovative Computational Intelligence: A Rough Guide to Clever Algorithms, Springer, 2014.(Unit 5)

## Reference Book

Hamdy A. Taha, Operations Research: An Introduction, Pearson, 2010

## Course outcome:

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

CO1	Develop Linear Programming models for industrial problems	K1-K6
CO2	Formulation of Transportation and Assignment problems for real life	K1-K6
CO3	Critical path estimation can be done for a project	K1-K6
CO4	Non-Linear optimization models can be solved	K1-K6
CO5	Evolutionary Optimization algorithms can be used to solve any optimization problems to overcome the issues in the traditional optimization models	K1-K6

## Mapping with Programme Outcomes

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

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

## Skill Enhancement Course [SEC]-II

<b>Semester</b>	<b>23MCAS305:Web Technologies Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>0</b>	<b>3</b>	<b>2</b>

### Course Objectives:

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

- Learn how to create web pages using HTML, CSS and Javascript.
- Implement dynamic web pages using Javascript, JQuery and Angular Java script
- To create web applications using PHP and MySQL
- Create web pages using XML and Cascading Style Sheets
- Create XML documents and Schemas.

### Program List

1. Develop a web page to display your education details in a tabular format.
2. Develop a web page to display your CV on a web page.
3. Design a Homepage having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.
4. Design a web page to demonstrate the usage of inline CSS, internal CSS and external CSS.
5. Design an XML document and create a style sheet in CSS & display the document in the browser.
6. Develop a web page to Create image maps.
7. Design a web page to perform input validation using Angular Javascript.
8. Develop a web page in PHP to fetch details from the database.
9. Design a web page to hide paragraph using JQuery
10. Create a web page and add Javascript to handle mouse events and form events

**Course Outcomes:**

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

<b>CO1</b>	Design dynamic web pages using JavaScript, JQuery and Angular JavaScript	K1	LO
<b>CO2</b>	Develop Web pages using HTML, CSS and XML	K2	IO
<b>CO3</b>	Create web application using PHP and MySQL	K3, K4	H O
<b>CO4</b>	Develop interactive web pages using JQuery	K2,K3	H O
<b>CO5</b>	To design dynamic web pages using Angular javascript	K4,K5	H O

**Mapping with Programme Outcomes**

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

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

<b>Semester</b>	<b>23MCAS305:Solution Architecture Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>III</b>		<b>0</b>	<b>3</b>	<b>2</b>

### Course Objectives:

- To get familiar with AWS cloud services
  - To design secure, scalable, and well structured cloud solutions
  - To create EC2 instance and configure options
  - To connect EC2 with Linux instance
  - To connect VPN server to securely access instances
11. Managing Virtual Private Cloud
  12. Creating and Configuring Internet Gateways
  13. Configuring Routing Tables
  14. Working with Amazon Elastic Cloud Compute (EC2)
  15. Connecting EC2 Linux instance using PuTTY, Gitbash and Console
  16. Recovering and connecting EC2 instance if the SSH key is lost
  17. Creating and Configuring Elastic Load Balancer
  18. Scheduling Auto Snapshot of volumes
  19. Configuring Centralized Log Management using CloudWatch Log
  20. Connecting OpenVPN server

### Course Outcomes

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

<b>CO1:</b>	Understand AWS cloud services and manage the cloud data	<b>K1- K6</b>
<b>CO2:</b>	Develop secure, scalable, and well structured cloud solutions	
<b>CO3:</b>	Implement EC2 instance and configure the instance	
<b>CO4:</b>	Connect EC2 with Linux instance and perform operations	
<b>CO5:</b>	To connect VPN server to access instances with more security	

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

### Mapping with Programme Outcomes

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

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

### Skill Enhancement Course [SEC]-III

<b>Semester</b>	<b>23MCAS405: Cyber Security Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>IV</b>		<b>0</b>	<b>4</b>	<b>2</b>

#### COURSE OBJECTIVES

- To learn and implement to Change the wireless device mode as monitor mode
- To develop in multiple vulnerabilities webserver
- To understand and implement the open ports in the network
- To acquire programming skills in Implement various wireless device modes
- To comprehend related to find the sub domains of webpage

Implement the following using any cyber security tools

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

#### Course Outcomes:

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

CO1:	Comprehend the programming skills in Change the wireless device mode as monitor mode	K1-K6
CO2:	Understand and implement multiple vulnerabilities webserver	K1-K6
CO3:	Evaluate the use of different wireless device modes	K1-K6
CO4:	Design to Solve related to find the subdomains of webpage	K1-K6
CO5:	Create and apply open ports in the network	K1-K6

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

### Mapping Course outcomes with Programme outcomes

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

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



<b>Semester</b>	<b>23MCAE405:Blockchain Technology Lab</b>	<b>L</b>	<b>P</b>	<b>C</b>
<b>IV</b>		<b>0</b>	<b>4</b>	<b>2</b>

### Course Objectives

- To learn the basics of Blockchain and apply cryptographic algorithms
- To design, build, and deploy smart contracts and distributed applications,
- To deploy Private Blockchain and smart contracts on Ethereum.
- To understand and deploy cryptocurrencies and their functions in applications
- To implement Blockchain for various use cases.

### Implement the following

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.

## Course Outcomes

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

CO1:	Enable to setup your own private Blockchain and deploy smart contracts on Ethereum.	K1-K6
CO2:	Gains familiarity and implement with cryptography and Consensus algorithms.	K1-K6
CO3:	Create and deploy projects using Web3j.	K1-K6
CO4:	Recall and deploy the structure and mechanism of Bitcoin, Ethereum, Hyperledger	K1-K6
CO5:	Implement Blockchain for various use cases	K1-K6

## Mapping with Programme Outcomes:

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

**S – Strong, M – Medium, L – Low**