Annamalai University

Faculty of Science

DEPARTMENTOFCOMPUTERANDINFORMATIONSCIENCE

Master of Computer Applications (M.C.A)

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 2025 – 2026.

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 section11.4.

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 TamilNadu 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 consist of two academic years.

4.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

4.3 Each semester will have 90 working days(18weeks).

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 as student can choose from arrange 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-planttraining/fieldtrip/internship/industrialvisitfallunderthiscategory.

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 40hours 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
PartA	Core (Theory)	40
	Core(Practical)	12
	Project with Viva-voce	20
PartB(i)	Elective(Generic/Discipline Centric)	15
PartB(ii)	Internship/Industrial Visit	02
PartB(iii)	Skill Enhancement Course/Professional Competency Skill	02
PartC	Extension Activity	01
	TOTALCREDITS	92

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

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

1Practical/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 There cord shall be submitted 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 cert a in 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 Thestudentsaretobeinformedinadvanceabouttheassessmentprocedures.

8.4.3 The pattern of question paper will be decided by the respective faculty.

8.4.4 CIA Tests will be for one or two-hours duration depending on the quantum of syllabus.

8.4.5 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

8.4.6 For the CIA Tests, the assessment will be done by the Course teacher

8.5 End Semester Examinations(ESE)

8.5.1 The ESE for the first and third semester will be conducted in November and for the second and fourth semester in May.

8.6 Candidates who failed in any course will be permitted to reappear in failed course in the subsequent examinations.

8.7 The ESE will be of three hours duration and will cover the entire syllabus of the course.

9 Evaluation

9.1 Marks Distribution

9.1.1 For each course, the Theory, Practical and project shall be evaluated for a maximum of 100 marks.

9.1.2 For the theory courses, CIA Tests will carry 25% and the ESE 75% of the marks.

9.1.3 For the Practical courses, the CIA Tests will carry 25% and the ESE 75% of the marks.

9.2 Assessment of CIA Tests

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

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

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

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

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

9.3 Assessment of End-Semester Examinations

9.3.1 Evaluation for the ESE is done by internal examiners.

9.4 Assessment of Project/Dissertation

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

9.4.2 The Project Work/Dissertation shall carry a maximum of 200 marks.

9.4.3 CIA for Project will consist of a Review of literature survey, experimentation/fieldwork, 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 (50 Marks)		End Semester Examination (200 Marks)	
Review-I	Review-II	Project/ Dissertation Evaluation	Viva voce
25	25	150	50

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; is the Grade

G_i 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 **Performanceofthestudentforeachcoursewillberatedasshowninthe Table.**

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

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

CGPA	CLASSIFICATIONOFFINALRESULT
8.25 and above	First Class with Distinction
6.5 and above but below 8.25	First Class
5.0 and above but below 6.5	Second Class
0.0 and above but below 5.0	Re-appear

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

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

11.6.2 **For First Class:** Candidates who have passed all the courses with a CGPA of 6.5 and above.

11.6.3 **For Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.

11.6.4 Candidates who obtain overall highest CGPA in all examinations in the first appearance itself are eligible for University Rank.

11.6.5 **Formula for Conversion of CGPA into Percentage**

CGPA×9.5=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 Candidateswhohavebeengrantedpermissiontowithdrawfromtheexaminationshall 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.

Programme	**M.C.A.,**
Programme Code	**SCIS23**
Duration	**PG-TwoYears**
Programme Outcomes(Pos)	**PO1: Problem Solving Skill -** Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. **PO2: Decision Making Skill -** Foster analytical and critical thinking abilities for data-based decision-making. **PO3: Ethical Value –** Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities. **PO4: Communication skill-**Ability to develop communication, managerial and interpersonal skills. **PO5: Individual and Team Leadership Skill-**Capability to lead themselves and the team to achieve organizational goals. **PO6: Employability Skill -** Inculcate contemporary business practices to enhance employ ability skills in the competitive environment. **PO7: Entrepreneurial Skill -** Equip with skills and competencies to become an entrepreneur. **PO8: Contribution to Society-** Succeed in career endeavors and contribute significantly to society. **PO 9 Multicultural competence -** Possess knowledge of the values and beliefs of multiple cultures anda global perspective. **PO 10: Moral and ethical awareness/reasoning -** Ability to embrace moral/ethical values in conducting one's life
Programme Specific Outcomes (PSOs)	**PSO1–Placement** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO2-Entrepreneur** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. **PSO3–Research and Development** Design and implement HR systems and practices grounded inresearch that comply with employment laws, leading the organization towards growth and development. **PSO4 –Contribution to Business World** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO5 –Contribution to the Society** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

Programme Outcomes(Po) –Programme Specific Outcomes (Pso) Mapping

PROGRAMME SPECIFIC OUTCOMES (PSO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	3	3	3	3	3	3	3	3	3	3
PSO2	3	3	3	2	3	3	3	2	3	3
PSO3	3	2	3	3	3	3	3	3	2	2
PSO4	3	3	3	3	3	3	3	3	3	3
PSO5	3	3	3	3	3	3	2	3	2	2

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 2025-2026)

Course Code	Course Title	Credit	Hours/ Week	Examination Duration (Hrs)	Marks		
					CIA	ESE	Total
Semester-I							
25MCAC101	Core –I Theory: Discrete Mathematics	4	4	3	25	75	100
25MCAC102	Core-II Theory: Data Structures and Algorithms	4	4	3	25	75	100
25MCAC103	Core-III Theory: Operating System	4	4	3	25	75	100
25MCAC104	Core-IV Theory: Relational Database Management System	4	4	3	25	75	100
25MCAE105	Elective-I: Java Programming	3	3	3	25	75	100
25MCAP106	Core –V Practical: Data Structure and Algorithms Lab	2	4	3	25	75	100
25MCAP107	Core –VI Practical: Oracle SQL & Mongo DB Lab	2	4	3	25	75	100
Total Credit		**23**	**27**	**Total Marks**			**700**
Semester-II							
25MCAC201	Core-VII Theory: Full Stack Development	4	4	3	25	75	100
25MCAC202	Core-VIII Theory: Python Programming	4	4	3	25	75	100
25MCAC203	Core-IX Theory: Computer Network	4	4	3	25	75	100
25MCAE204	Elective - II: Machine Learning	3	3	3	25	75	100
25MCAE205	Elective – III: Natural Language Processing	3	3	3	25	75	100
25MCAP206	Core –X Practical: Full Stack Development Lab	2	4	3	25	75	100
25MCAP207	Core –XI Practical: Machine Learning Lab	2	4	3	25	75	100
25MCAS208	Internship / Industrial Activity	2	-	-	-	-	100
Total Credit		**24**	**26**	**Total Marks**			**800**

Semester-III							
25MCAC301	Core-XII Theory: Software Engineering	4	4	3	25	75	100
25MCAC302	Core-XIII Theory: Big Data Analytics	4	4	3	25	75	100
25MCAC303	Core-XIV Theory: Mobile App Development	4	4	3	25	75	100
25MCAE304	Elective-IV: Cloud Computing	3	3	3	25	75	100
23MCAE305	Elective-V: Cyber Security	3	3	3	25	75	100
23MCAP306	Core-XV Practical: Cloud Computing Lab	2	4	3	25	75	100
25MCAP307	Core-XVI Practical: Mobile App Development Lab	2	4	3	25	75	100
25MCAI308	Skill Enhancement Course	2	-	-	-	-	100
	Total Credit	**24**	**26**		**Total Marks**		**800**

Semester-IV							
25MCAP401	Project work and Viva Voce	20	-	-	50	150	200
	Total Credit	20		**Total Marks**			**200**
	Over all Credit Score	**91**		**Over all Total Marks**			**2500**

ELECTIVE COURSES

Paper Code	Course Title
Semester - I	
25MCAE105	Java Programming
	Dot Net Technologies
	Go Programming
Semester - II	
25MCAE204	Machine Learning
	Computer Vision
	Grid Computing
25MCAE205	Nature Language Processing
	Internet of Things(IoT)
	Deep and Reinforcement Learning
Semester - III	
25MCAE304	Cloud Computing
	Bio inspired learning
	Generative AI
25MCAE305	Cyber Security
	Cryptocurrency and Blockchain Technologies
	Intelligent Information system

Semester	25MCAC101:DISCRETE MATHEMATICS	L	P	C
I		4	0	4

Course Objectives

- 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 bya 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 in distinguishable 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, Third edition, PHI Learning Private Limited, New Delhi, 2013.

Reference Books:

1. Kevin Ferland," Discrete Mathematics and Applications" ,second Edition, Kindle Edition,CRC Press,2017.
2. Kimmo Eriksson and Hillevi Gavel, " Discrete Mathematics & Discrete Models" , Student litteratur AB, 2015.
3. Kenneth H.Rosen, " Discrete Mathematics and Applications", Seventh Edition, Connect Learn Succeed,2012.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	K1-K5
CO2:	To analyze and evaluate the recurrence relations	
CO3:	To distinguish among various normal forms and predicate calculus	
CO4:	To solve and know various types of matrices	
CO5:	To evaluate and solve various types of graphs	

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Semester	25MCAC102: DATA STRUCTURES AND ALGORITHMS	L	P	C
I		4	0	4

Course Objectives:

- To learn the fundamentals of Data Structures and Classifications.
- To get a clear understanding of various ADT structures with real-time scenarios.
- To understand the usage of algorithms in computing.
- To apply appropriate algorithms based on the problem domain.
- To learn Linear Data Structures and their implementations.
- To understand Non Linear Data Structures and their implementations.
- To understand the Sorting, Searching Hash techniques.
- To analyze the various data structures with their different implementations.

UNIT-I

Introduction to Data Structure: Elementary of Data Structure Organization-Classification-ADT -Array-implementation- List ADT-Linked List implementation-Singly linked list-Doubly Linked List-Circular Linked List-Applications.

UNIT-II

Algorithm Analysis: Algorithms- Time and Space Complexity Analysis- Asymptotic analysis-Best Case-Average case- Worst Case--Notations- Recursion- Analyzing Recursive Algorithms-Linear Recursion-Binary Recursion.

UNIT-III

Linear Data Structure: Stack ADT-Implementations-Applications-Queue ADT-Implementations-Circular Queue-Priority-Queue-deQueue-Applications of Queues.

UNIT-IV

Non-Linear Data Structure: Tree -Operations-Binary Tree and types-Traversal Algorithms-Binary search Tree-AVL Trees-B-Trees-Splay Trees-Heap-Heap Implementation. Graph Representation-Types of Graph - Graph Traversal Algorithms-Shortest path Algorithms-minimum spanning Trees-Dijkstra Algorithm-Applications of Graphs.

UNIT-V

Searching, Sorting and Hashing Techniques: Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort - Merge sort – Quick sort- Hashing- Hash Table-Hash Functions.

Text Books

1. Reema Thareja,"Data Structures Using C",Second Edition,OXFORD Universtiy Press,2014.
2. Adam Drozdex, “Data Structures and Algorithms in C++”, Cengage Learning, 4th Edition, 2013.
3. Mark Allen Weiss,"Data structures and algorithm analysis in C++",Fourth Edition,Pearson,2014.

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.

3. Bradley N. Miller, David L. Ranum, " Problem Solving with Algorithms and Data Structures using Python " , Second Edition, 2013.

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

Semester	25MCAC103: OPERATING SYSTEM	L	P	C
I		4	0	4

Course Objectives:

To understand the basics and functions of operating systems.
To understand processes and threads
To analyze scheduling algorithms and process synchronization.
To understand the concept of deadlocks.
To analyze various memory management schemes.
To be familiar with I/O management and file systems.
To be familiar with the basics of virtual machines and Mobile OS like iOS and Android.

UNIT I

INTRODUCTION :Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

UNIT II

PROCESS MANAGEMENT: Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads -Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem -Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization -Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III

MEMORY MANAGEMENT: Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table -Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write – Page Replacement - Allocation of Frames –Thrashing.

UNIT IV

STORAGE MANAGEMENT: Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface -File concept - Access methods - Directory Structure - Directory organization - File system mounting- File Sharing and Protection; File System Implementation - File System Structure – Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V

VIRTUAL MACHINES AND MOBILE OS 7:Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10th Edition, John Wiley and Sons Inc., 2018.

2. Andrew S Tanenbaum, "Modern Operating Systems", 5th Edition, Pearson, 2022.

Reference Books:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, " Operating Systems – A Spiral Approach",Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S.Godbole and Atul Kahate, "Operating Systems", 4th Edition, McGraw Hill Education, 2016.

Course Outcomes:

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

CO1	Analyze the structure of OS and basic architectural components involved in design	K1-K6
CO2	Study the process management and Deadlock concept with solution	
CO3	Learn the Memory management system	
CO4	To understand, apply and summarize the storage and File system	
CO5	Understanding the Mobile OS and Android.	

Mapping with Programme Outcomes:

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

L-Low, M-Medium, S-Strong

Semester	25MCAC104: RELATIONAL DATABASE MANAGEMENT SYSTEM	L	P	C
I		4	0	4

Course objectives:

- To enable the students to understand the basics of database management systems.
- To enable the students to understand ER model, structure of relational database and indexing.
- To enable the students to apply advance database concepts to create secured, distributed databases.

UNIT I

Database System: Overview of database systems: Managing data - A historical perspective - File systems versus a DBMS - Advantages of a DBMS - Describing and storing data in a DBMS - Queries in a DBMS - Transaction management - Structure of a DBMS. Database design & ER diagrams – Entities, Attributes, and Entity Sets – Relationships and Relationship Sets - Additional features of the ER model - Conceptual database design with the ER model.

UNIT II

Relational Model: Relational Model: Integrity constraints over relations - Enforcing integrity constraints - Querying relational data - Logical database design: ER to Relational - Introduction to Views - Destroying / Altering Tables & Views. Relational Algebra and Calculus: Relational Algebra - Relational Calculus.

UNIT III

SQL: Queries, Programming, Triggers: The form of a basic SQL Query - UNION, INTERSECT and EXCEPT - Nested Queries - Aggregate operators - Null values - Complex integrity constraints in SQL - Triggers & Active databases.

Transaction Management Overview: The ACID Properties - Transactions & Schedules - Concurrent execution of Transactions - Lock-based concurrency control - Performance of Locking - Transaction support in SQL.

UNIT IV

Normal Forms And Security: Schema Refinement and Normal forms: Introduction to Schema refinement - Functional dependencies - Reasoning about functional dependencies - Normal forms - Properties of Decompositions - Normalization - Schema Refinement in database design - Other kinds of dependencies.

Security: Introduction to Database security - Access control - Discretionary Access control - Mandatory Access control - Additional issues to security.

Concurrency control: 2PL, serializability and Recoverability - Introduction to Lock Management - Lock Conversions - Specialized Locking techniques - Concurrency control without locking.

UNIT V

Distributed Database: Parallel & Distributed databases: Introduction - Architecture for parallel databases - Parallel Query evaluation - Parallelizing individual operations - Parallel Query Optimization - Introduction to distributed databases - Distributed DBMS architecture - Sorting data in a distributed DBMS.

Object Database Systems: Motivation Example - Structured data types - Operations on structured data types - Encapsulation & ADTs - Inheritance - Objects, OIDs and Reference Types - Database design for an ORDBMS - OODBMS - Comparing RDBMS, OODBMS and ORDBMS.

Text Books

1. Ramakrishnan, Johannes Gehrke – "Database Management Systems", Third Edition, McGraw-Hill Education,2022.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan – "Database System Concepts", Seventh Edition, McGraw-Hill Higher Education,2021.

Reference Books

1. Elmasri Ramez , Navathe Shamkant– "Fundamentals of Database Systems", Seventh Edition, Pearson India,2017.
2. S. S. Khandare ,"Database Management and Oracle Programming", Second Edition, S Chand Edutech Pvt Ltd Noida,2017.

Course Outcomes:

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

CO1	Overview of Relational Data base concepts and analyses the relationship with the enterprise	K1- K6
CO2	Analyze Relational Model and concept of ER diagram	
CO3	Understand and implement SQL queries	
CO4	Evaluate the Normalization and Schema Refinement in database design	
CO5	Learn Object Database system and Comparing RDBMS, OODBMS and ORDBMS.	

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	L
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	L	S	S	M	S	S
CO5	S	S	S	S	S	S	L	S	L	M

L - Low, M- Medium, S – Strong

Semester	25MCAP106:DATASTRUCTURES AND ALGORITHMS LAB	L	P	C
I		0	4	2

Course Objectives:

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

Implement the following problems using Java and above

1. Write a program in java program to find the minimum and maximum values in an array ADT.
2. Write a java program to demonstrate the Singly Linked List.
3. Write a java program to implement the Double Linked list to solve the problem.
4. Write a java program to demonstrate the recursion technique to solve the problem.
5. Write a java program to demonstrate the Stack Algorithm and its operations.
6. Write a java programs to Convert Infix to Postfix Expression using Stack ADT.
7. Write a java program to implement the Queue Algorithm to solve the problem.
8. Write a java program to find data element index position using Binary search algorithm.
9. Write a java program to demonstrate the Traversal Algorithms.
10. Write a java program to implement the sorting algorithm to order the given numbers as below.
    a) Insertion Sort
    b) Merge Sort
    c) Selection Sort

Course Outcomes:

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

CO1	Strong understanding in various ADT concepts	K1-K6
CO2	To be come 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

Semester	25MCAP107: ORACLE SQL/PLSQL AND MONGODB LAB	L	P	C
I		0	4	2

Course Objectives

- To develop SQL queries and PL/SQL procedures for relational databases using Oracle.
- To understand and perform CRUD operations using MongoDB.
- To compare and contrast relational vs. NoSQL data models.
- To apply database concepts for real-world application scenarios.

List of Practical Exercises

Oracle SQL and PL/SQL (Relational DB)

1. **Basic SQL Operations**
   Creating tables, inserting data, altering schema, and deleting records.
2. **Advanced SQL Queries**
   Joins, Nested queries, Group By, Having, Order By.
3. **Views and Indexes**
   Creating and managing views and indexes.
4. **PL/SQL Blocks**
   Anonymous blocks, variables, control structures.
5. **Procedures and Functions**
   Creating stored procedures and user-defined functions.
6. **Cursors**
   Implicit and explicit cursors.
7. **Triggers**
   Row-level and statement-level triggers.

MongoDB (NoSQL DB)

8. **MongoDB Setup and Basic Commands**
   Start Mongo shell, create databases and collections.
9. **CRUD Operations**
   Insert, Find, Update, and Delete documents.
10. **Query Operators**
    Using comparison, logical, and array operators.
11. **Aggregation Framework**
    Grouping, filtering, and transforming data using $group, $match, $project.
12. **Indexing and Performance**
    Create indexes and analyze performance.
13. **Data Modeling in MongoDB**

Embedded documents vs. referencing.

14. **Integration Example (Optional)**

Java/Python app connecting to Oracle and MongoDB.

Course Outcomes

After successful completion, students will be able to:

CO1	Efficient SQL queries and PL/SQL programs in Oracle.	K1-K5
CO2	Perform CRUD and aggregate operations in MongoDB.	
CO3	Compare relational and NoSQL data models.	
CO4	Apply the right database solution based on application needs.	
CO5	Design and manipulate complex data in both Oracle and MongoDB.	

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	M	M	M	L	S	M	S	L
CO3	S	S	S	L	L	L	M	M	M	M
CO4	S	S	M	M	M	S	M	L	S	S
CO5	S	S	S	S	L	M	S	M	M	L

L-Low,M-Medium,S-Strong

Semester	25MCAC201: FULL STACK DEVELOPMENT	L	P	C
II		4	0	4

Course Objectives:

- To understand the fundamentals of web programming and client-side scripting.
- To learn server-side development using NodeJS.
- To understand API development with Express Framework.
- To understand and architect databases using NoSQL and SQL databases.
- To learn the advanced client-side scripting and ReactJS framework.

UNIT- I

Introduction To CSS And Javascript: Web Introduction: Server, Client, Communication Protocol (HTTP) -Structure of HTML Documents – Basic Markup Tags - Working with Text and Images using CSS – CSS Selectors – CSS Flexbox -JavaScript: Data Types and Variables, Functions, EventsAJAX: GET and POST

UNIT- II

Server Side Programming With Nodejs: Web Servers – JavaScript for Desktop with NodeJS – NPM -Serving Files with the HTTP Module - Express Framework – Server-side Rendering with Templating Engines – Static Files-async/await – Fetching JSON from Express.

UNIT- III

Advanced Nodejs And Database: NoSQL Databases – MongoDB Overview – Querying with MongoDB Shell -Request Body Parsing in Express – NodeJS MongoDB Connection-Adding/Retrieving Data from MongoDB – Handling SQL Databases in NodeJS-Handling Cookies and User Authentication with NodeJS.

UNIT- IV

Advanced Client Side Programming: ReactJS: ReactDOM, JSX, Components, Props, State and Lifecycle -Fetch API – LocalStorage – Events – Lifting State Up – Composition and Inheritance

UNIT- V

App Implementation In Cloud: Overview of Cloud Providers -Virtual Private Cloud – Horizontal and Vertical ScalingVirtual Machines, Ethernet, and Switches -Docker Containers – Kubernetes

Text Books

1. David Flanagan, JavaScript: The Definitive Guide, 7th Editon., O'Reilly, 2020.
2. Alex Banks, Eve Porcello, Learning React, 2nd Ed., O'Reilly, 2020.

3. Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

Reference Books

1. Matt Frisbie, Professional JavaScript for Web Developers, Wiley, 4th Ed., 2019.
2. Marc Wandschneider, Learning Node, Addison-Wesley, 2nd Ed., 2016.
3. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018.

Course Outcomes:

After successful completion, students will be able to:

CO1	Strong understanding client-side scripting using HTML, CSS, and JavaScript	K1-K6
CO2	Implement and architect the server side of a web application	
CO3	Implement web applications using NodeJS.	
CO4	Study the Architect NoSQL databases using MongoDB	
CO5	Implement full-stack single-page applications using React, NodeJS, and MongoDB, and deploy on cloud platforms	

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	L	M	S
CO3	S	S	S	S	M	S	M	S	S	M
CO4	S	S	M	S	L	S	S	M	M	L
CO5	S	S	S	S	S	S	L	S	L	M

L - Low, M- Medium, S – Strong

Semester	23MCAC202:PYTHON PROGRAMMING	L	P	C
II		4	0	4

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 Graphical User 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 Books:

1. K.A.Lambert,"FundamentalsofPython:firstprograms",SecondEdition,Cengage Learning, 2018.

2. FabioNelli,“PythonDataAnalytics:WithPandas,NumPy,andMatplotlib”,Second Edition, Kindle Edition, 2018.
3. Antonio Mele, “Django 5 By Example: Build powerful and reliable Python web applications from scratch ”, Fifth Edition, 2024.

Reference Books:

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

Course Outcomes

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	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

Semester	25MCAC203:COMPUTER NETWORK	L	P	C
II		4	0	4

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 outing protocols and IP addressing.
- Study the transport layer and network security

UNIT-I

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-II

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-III

Elementary data link protocols: Sliding window protocols–Example Data Linkprotocols–PacketoverSONET,ADSL-MediumAccessLayer–ChannelAllocationProblem–Multiple Access Protocols.

UNIT-IV

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

UNIT-V

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,"Computer Networks", Fourth Edition ,Low price Edition ,2018.

Reference Books:

1. Teresa C.Piliouras, "Network Design Management Technical Perspective", Second Edition Auerbach Publishers, ,2015.
2. Douglas E. comer, "Internetworking with TCP/IP-Volume-I", PHI, Sixth Edition, 2013.

Course Outcomes(CO):

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

CO1	Understand the terminology and concepts of the OSI reference model	K1-K6
CO2	Student will get the knowledge of protocols, network interfaces, and design issues in local area networks and wide area networks.	
CO3	Understand wireless networking concepts, and be familiar with contemporary issues in networking technologies.	
CO4	Gain knowledge the network tools and network programming.	
CO5	Understand the Establishing and Releasing a connection in transport layer.	

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

Mapping with Programme Outcomes:

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

Strong;M-Medium;L-Low

Semester	25MCAP206: FULL STACK DEVELOPMENT LAB	L	P	C
II		0	4	2

COURSEOBJECTIVES:

- To implement the client side of the web application using JavaScript.
- To understand JavaScript on the desktop using NodeJS.
- To develop a web application using NodeJS and Express.
- To implement a SPA using React.
- To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL).

LIST OF EXPERIMENTS:

1. Create a form and validate the contents of the form using JavaScript.
2. Get data using Fetch API from an open-source endpoint and display the contents in the form of a card.
3. Create a NodeJS server that serves static HTML and CSS files to the user without using e express.
4. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.
5. Create a NodeJS server using Express that creates, reads, updates and deletes students' details and stores them in MongoDB database. The information about the user should be obtained from a HTML form.
6. Create a NodeJS server that creates, reads, updates and deletes event details and stores them in a MySQL database. The information about the user should be obtained from a HTML form.
7. Create a counter using ReactJS
8. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
9. Create a simple Sign up and Login mechanism and authenticate the user using cookies. The user information can be stored in either MongoDB or MySQL and the server should be built using NodeJS and Express Framework.
10. Create and deploy a virtual machine using a virtual box that can be accessed from the host computer using SSH.

SOFTWAREREQUIREMENTS

1. NodeJS/Express JS, ReactJS, Docker, any IDE like NOTEPAD++/visual studio code/sublime text etc.,
2. MySQL,MongoDB.

COURSEOUTCOMES:

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

CO1	To implement and deploy the client side of the web application.	**K1-K6**
CO2	To develop and deploy server side applications using NodeJS.	
CO3	To use Express framework in web development.	
CO4	To implement and architect database systems in both NoSQL and SQL environments.	
CO5	To develop a full stack single page application using React, NodeJS, and a Database and deploy using containers.	

Mapping with Programme Outcomes

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

Semester	25MCAP207:MACHINE LEARNING LAB	L	P	C
II		0	4	2

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. ImplementaLinearRegressionandMultipleLinearRegressionwithaRealDataset
3. Implementation of Logistic Regression using sklearn
4. Implement a binary classification model.
5. Classification with Nearest Neighbours and Navie BayeAlgorithm
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 Auto encoder in TensorFlow/Keras.
10. Implement a Simple LSTM using TensorFlow/Keras.

Course Outcomes

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

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

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

S-Strong;M-Medium;L-Low

Semester	25MCAI208: INTERNSHIP /INDUSTRIAL ACTIVITY	L	P	C
II		0	0	2

Course Description

This internship module provides students with an opportunity to gain real-world experience by working in an industry, research lab, or relevant organization for a minimum of four weeks. During this period, students will apply the theoretical knowledge acquired in the classroom to practical problems, develop professional skills, and understand workplace practices and ethics.

Learning Objectives

- By the end of the internship, students will be able to:
- Apply core engineering and management concepts to solve real-world problems.
- Communicate effectively with supervisors, peers, and clients in a professional environment.
- Work collaboratively in multidisciplinary teams to achieve project goals.
- Reflect on ethical, societal, and organizational aspects of their work.
- Document, present, and defend their project work in written and oral formats.

Internship Guidelines

Students must secure an internship position in an organization aligned with their area of study. The host organization should assign a mentor who will define the scope of work, supervise progress, and evaluate performance. Students are responsible for:

1. Maintaining regular attendance and punctuality as per host organization norms.
2. Following all safety, confidentiality, and professional conduct requirements.
3. Keeping a daily log of tasks performed, skills acquired, and challenges encountered.

Deliverables and Assessment

1. **Weekly Logbook (30%)**: A journal documenting daily activities, learning outcomes, and reflections.
2. **Mid-Term Progress Report (20%)**: A brief summary of tasks completed and initial observations, submitted after two weeks.
3. **Final Project Report (30%)**: A comprehensive document (5,000–7,000 words) detailing objectives, methodology, results, and recommendations.
4. **Oral Presentation and Defense (20%)**: A 15-minute presentation before a faculty panel, followed by Q&A.

Course Outcomes

- Upon successful completion, students will be able to:
- Integrate academic knowledge with industry practices.
- Demonstrate professional communication and teamwork skills.
- Analyze workplace challenges and propose effective solutions.
- Produce well-structured technical documentation and deliver persuasive presentations.

Recommended Readings & Resources

- The Complete Guide to Internship Success, Laura Pawelski, 2019.
- Professional Skills for the Workplace, Sarah Smith, 2020.
- Host organization's internal manuals and standard operating procedures.

Total Duration: Minimum 4 weeks (full-time)

Note: Students must obtain approval from the departmental internship coordinator before commencing the internship, and submit all deliverables by the deadlines specified in the departmental internship handbook.

Semester	25MCAC301: SOFTWARE ENGINEERING	L	P	C
III		4	0	4

COURSE OBJECTIVES:

- To understand the role of software Engineering.
- To learn the mechanisms of developing software.
- To identify the risks n software development.
- To understand the design concepts testing methods and strategies.
- To understand and collect the requirement of software engineering.

Unit-I

Introduction: A Generic View of Process–Process Models-The Waterfall Model-Incremental Model- Evolutionary Model-Specialized Model-The Unified Process–Agile Process – Agile Models–Software Cost Estimation–Planning –Risk Analysis–Software Project Scheduling.

Unit-II

Requirement Analysis: System Engineering Hierarchy –System Modeling– Requirements Engineering: Tasks- Initiating The Process-Eliciting requirements-Developing Use Cases-Negotiating Requirements-Validating Requirements–Building the Analysis Models: Concepts

Unit-III

Software Design: Design Concepts–Design Models–Pattern Based Design– Architectural Design–Component Level Design–Component–Class Based And Conventional Components Design–User Interface–Analysis And Design.

Unit-IV

Software Testing : Software Testing–Strategies: Conventional-Object Oriented– Validation Testing– Criteria–Alpha–Beta Testing- System Testing –Recovery– Security–Stress–Performance –Testing Tactics–Testing Fundamentals-Black Box–While Box–Basis Path-Control Structure.

Unit-V

Software configuration and Management, and Quality Assurance: Software Configuration And Management-Features-SCM Process-Software Quality Concepts – Quality Assurance – Software Review–Technical Reviews – Formal Approach To Software Quality Assurance–Reliability–Quality Standards–Software Quality Assurance Plan.

Text Book:

1. Ian Sommerville,"Software Engineering",Ninth Edition,Person Edition,2021.

Reference Books:

1. Pankaj Jalote, "An Integrated Approach to Software Engineering", Third Edition, Narosa publications, 2011.
2. Pressman, Roger S,"Software engineering : a practitioner's approach ", Seventh Edition, McGrawHill Higer Education,2010
3. NPTEL online course – Software Engineering - https://nptel.ac.in/courses/106105182/

Course Outcomes

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

CO1	Understand the terminology and concepts of the Cloud computing	**K1-K6**
CO2	Student will get the knowledge of Virtualization and virtual machines	
CO3	Gain the knowledge of Docker	
CO4	Familiar with Amazon AWS	
CO5	Understand the cloud security and IAM	

Mapping with Programme Outcomes

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

S-Strong;M-Medium;L-Low

Semester	25MCAC302: BIGDATA ANALYTICS	L	P	C
III		4	0	4

Course Objectives

- To introduce bigdata tools and Information Standard formats.
- To understand the basic concepts of bigdata.
- 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 MapreduceProgramming: 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 LanguageStatements–Partitions–Bucketing– Views -Sub-Query–Joins–Aggregations-Group byand 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 Books:

1. Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. ,2013.
2. TomWhite,"Hadoop TheDefinitiveGuide",O'ReillyPublications, Fourth Edition, 2015
3. Dirk Deroos, Paul C.Zikopoulos, Roman B.Melnky, Bruce Brown, Rafael Coss, "Hadoop For Dummies", Wiley Publications, 2014.
4. RobertD.Schneider, "HadoopForDummies",JohnWiley&Sons, Inc.,2012.

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.	
CO3	To comprehend, implement and review the concepts of data science and bigdata analytics projects using Map Reduce, and MongoDB	
CO4	To understand, use and analyze the concepts of bigdata analytics projects Using HIVE database.	
CO5	To illustrate, develop and review the concepts of PIG database in Hadoop environment.	

K1-Remember,K2-Understand,K3-Apply,K4-Analyze,K5Evaluate,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	S
CO2	S	S	M	M	M	M	S	L	M	M
CO3	S	M	S	S	S	L	M	S	L	M
CO4	S	M	S	M	S	M	S	M	S	M
CO5	S	L	S	S	S	L	S	S	M	L

S-Strong;M-Medium;L-Low

Semester	25MCAC303:MOBILE APP DEVELOPMENT	L	P	C
III		4	0	4

OBJECTIVES:

To understand the needs and characteristics of mobile applications.
To design effective user interfaces for mobile applications.
To identify and address design issues in mobile application development.
To understand the development procedures for mobile applications.
To develop mobile applications using various tools and platforms.

UNIT I

Mobile Platform And Applications

Mobile Device Operating Systems -Special Constraints & Requirements - Commercial Mobile Operating Systems -Software Development Kit: iOS, Android, BlackBerry, Windows Phone - M-Commerce -Structure -Mobile Payment System- Security and Hacking.

UNIT-II

Introduction To Android

The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT-III

Android Application Design Essentials

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

UNIT-IV

Android User Interface Design & Multimedia

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures.

UNIT-V

Mobile Application Development

Mobile Applications Development - Understanding the Android Software Stack – Android Application Architecture –The Android Application Life Cycle – The Activity Life Cycle Creating Android Activity – Data Storage, Retrieval and Sharing.-Location based services- Development of simple mobile applications.

Text Books

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide”, 4th edition, Big Nerd Ranch, 2019.
2. Reto Meier, Ian Lake, “Professional Android”, 4th Edition, Wrox, 2018.
3. Barry Burd, “Android Application Development All-In-One for Dummies”, 3rd Edition, 2021.

Reference Books

1. C.Firza Afreen,"Mobile Applications Development",Book Rivers,2021.
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, “Programming
3. Android”, 2nd Edition, O’Reilly, 2012.
4. Alasdair Allan, “Learning iOS Programming”, 3rd Edition, O’Reilly, 2013.
5. Christian Keur, Aaron Hillegass, iOS Programming: The Big Nerd Ranch Guide, 6th Edition, O’Reilly, 2016.

Course Outcomes

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

CO1	Understand the basics of mobile application development frameworks and tools.	K1-K6
CO2	Develop a UI for mobile applications.	
CO3	Design mobile applications that manage memory dynamically	
CO4	Build applications based on mobile OS like Android, iOS	
CO5	Build location based services	

K1-Remember,K2-Understand,K3-Apply,K4-Analyze,K5Evaluate,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	S
CO2	S	S	M	M	M	M	S	L	M	M
CO3	S	M	S	S	S	L	M	S	L	M
CO4	S	M	S	M	S	M	S	M	S	M
CO5	S	L	S	S	S	L	S	S	M	L

S-Strong;M-Medium;L-Low

Semester	23MCAP306:CLOUD COMPUTING LAB	L	P	C
III		0	4	2

Course Objectives:

- To exposed to tool kits for cloud environment.
- Familiar with migration of Virtual Machines from one node to another
- Learn to run virtual machines of different configuration.

PRACTICAL EXERCISES

1. Install Virtualbox/VMware/Equivalent open source cloud workstation with different flavors of Linux or Windows OS on top of Windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute simple programs.
3. Install Google App Engine. Create a "Hello World" app and other simple web applications using Python/Java.
4. Use the GAE launcher to launch the web applications.
5. Find procedure to install storage controller and interact with it.
6. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
7. Find a procedure to transfer files from one virtual machine to another virtual machine.
8. Install Hadoop single node cluster and run simple applications like WordCount.
9. Create and execute your first container using Docker.
10. Run a container from Docker Hub.

Course Outcomes

After successful completion, students will be able to:

CO1	Understand the Cloud computing workstation with different the OS.	K1-K5
CO2	Student will get the knowledge of Virtual box and virtual machine	
CO3	Familiar with hadoop in cloud environments	
CO4	Practice the web application with Google app Engine.	
CO5	Understand and implement the Docker	

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

L-Low,M-Medium,S-Strong

Semester	23MCAP307:MOBILE APP DEVELOPMENT LAB	L	P	C
III		0	4	2

Course Objectives

- 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.
- TogetclearunderstandingofmobileapplicationdevelopmentwithWML/J2ME.
- Togetadvancedmethodsformobileapplicationthatmakesuseofanydatabase.

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 phonebook 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.	
CO3	Appraise the best features Programs for creating dynamic and interactive web pages using forms.	
CO4	Create a Mobile application to view the live streaming using video view.	
CO5	Create a mobile application that makes use of any database.	

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

S-Strong; M-Medium; L-Low

Semester	25MCAP401: PROJECT WORK AND VIVA VOCE	L	P	C
IV		0	0	20

COURSE OBJECTIVES:

- To apply the theoretical concepts learned throughout the course in real-world projects
- To develop practical skills in research, analysis, and problem-solving
- To foster critical thinking and creativity in project development
- To enhance presentation and communication skills through the Viva Voce
- To evaluate and assess the students' ability to work independently and collaboratively

COURSE CONTENT:

Project Work:

- Each student is required to select a project topic related to their area of interest or specialization in the field of Artificial Intelligence, Machine Learning, Computer Vision, Data Science, or any other relevant field.
- The project should address a real-world problem and propose innovative solutions using suitable technologies and tools.
- Students must demonstrate the following stages of the project:
  - Problem definition and scope
  - Literature review and background study
  - Design and development of the project
  - Testing and validation of the solution
  - Documentation and presentation of the project

Viva Voce:

- The Viva Voce is an oral examination to assess the students' understanding of their project, including concepts, methods, and tools used.
- Students should be prepared to explain their project's objectives, methodologies, results, and future scope.
- The Viva Voce will also assess the students' ability to present their work clearly and confidently, answering questions from the panel.

PROJECT GUIDELINES:

- The project can be individual or in small groups (if allowed by the department).

- The project should involve practical implementation and not just theoretical work.
- A supervisor will be assigned to guide each student/group through the project.
- Regular progress reports and meetings with the supervisor will be required.
- The final project should be presented in the form of a written report and a presentation during the Viva Voce.

EVALUATION CRITERIA:

1. **Project Proposal (10%)**: Clear problem statement, objectives, and approach.
2. **Implementation and Design (40%)**: Effective use of tools, technologies, and methodologies.
3. **Testing and Results (20%)**: Validity and reliability of the results obtained.
4. **Project Report (15%)**: Documentation, structure, and clarity of the report.
5. **Viva Voce (15%)**: Understanding of the project, communication skills, and response to questions.

COURSE OUTCOMES:

CO1: Demonstrate the ability to apply theoretical concepts to practical problems through project work

CO2: Develop critical thinking and problem-solving skills

CO3: Present the project clearly and professionally in both written and oral forms

CO4: Communicate complex ideas effectively in the Viva Voce examination

CO5: Prepare a well-documented report and presentation

CO6: Gain practical experience in the chosen area of specialization and make a valuable contribution to the field.

Semester	25MCAE105: JAVA PROGRAMMING	L	P	C
I		4	0	4

Course Objectives:

- To understand Object Oriented Concepts using Java Language.
- To develop, debug and document programs in Java using OOP paradigms.
- Describe the meaning of the object-oriented paradigm and implement real-world entities like inheritance, hiding, polymorphism in programming using the object-oriented design process.
- To understand and implement core Java concepts as interface, package, exception handling, etc.
- To understand and develop GUI components using Applets.
- To understand and develop applications using Servlets/JSPs with database handling.

UNIT-I: Introduction

Object Oriented Programming: Objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Virtual Machine, Java Source File Structure, and Compilation.

Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifiers, static members, Comments, Data Types, Variables, Operators, Control Flow, Arrays and Strings.

UNIT-II: Inheritance, Interfaces and Packages

Inheritance: Super classes, sub classes, protected members, method overloading, constructor overloading, use of this and super keyword, Object class, abstract classes and methods.

Interfaces: Defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.

Packages: Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, importing and naming convention for Packages.

UNIT-III: Exception Handling, I/O, Multithreading

Exceptions: Exception hierarchy, checked and unchecked exceptions, throwing and catching exceptions, finally clause, built-in exceptions, creating own exceptions, Stack Trace Elements, catching exceptions.

Input / Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and Writing Files.

Multithreading: Thread life cycle, creating threads, synchronizing threads, Inter thread communication.

UNIT- IV: Applets, Graphics, Event Handling and Swing

Applets: Applet classes, Applet life cycle, creating a simple applet, passing parameters through html, Graphical shapes, Colors, Fonts.
AWT: Introduction, labels, buttons, check boxes, etc.; Layout manager: Flow layout, border layout, grid layout, card layout; Menus: Dialog boxes, File dialog; Introduction of Java Swing.

Event Handling: Event Classes, Event Listener Interfaces.

UNIT- V: Networking and Database Handling with JDBC

Java Networking: Basics of Networking, Networking in Java, Socket Program using TCP/IP, Socket Program using UDP, URL and Inet address classes.

JDBC – Introduction, JDBC Architecture, JDBC Classes and Interfaces, Database Access with MySQL, Developing JDBC application, Creating a New Database and Table with JDBC, Working with Database Metadata.

Text Books:

1. Herbert Schildt, Dr. Danny Coward ,Java: The Complete Reference, 13th Edition, Mc Graw-Hill, ,2024.
2. Kathy Sierra, Bert Bares & Trisha Gee: Head First Java, 3rd Edition, O'Reilly Media, 2022.

Reference Books:

1. Paul Deitel and Harvey Deitel: Java: How to Program, Late Objects, 11th Edition, Pearson, 2021.
2. Java Server Programming Java EE 7 (J2EE 1.7), Black Book, by Kogent Learning Solutions Inc., Publisher(s): Dreamtech Press, 2014.

Course Outcomes:

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

CO1	To understand Object Oriented Concepts using Java and understand/implement Java programming basics as data types, variable, constants, operators, control statements, arrays, etc.	K1-K6
CO2	To understand and implement concepts of inheritance, interfaces and packages etc. in Java programming.	
CO3	To handle exceptions in programs and gain practical experience on using I/O, multithreading, etc.	
CO4	Explain and implementation approaches for GUI design using Applets, Swing and the Event handling mechanism.	
CO5	Design and implement interactive applications using Networking and database handling	

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	M	S	S	S	S	S	S
CO3	S	M	S	S	M	M	M	S	M	M
CO4	S	S	S	S	L	S	S	M	S	L
CO5	S	S	S	S	S	S	L	S	L	M

L - Low, M- Medium, S – Strong

Semester	25MCAE105:GO PROGRAMMING	L	P	C
I		3	0	3

Course Objectives

- To introduce the basic concepts and syntax of Go programming
- To develop understanding of variables, control structures, functions, and packages in Go
- To explore Go's server programming and microservice features
- To implement concurrent programming using go routines and channels in Go
- To encourage application development using Go with modern development practices and tools

UNIT I – Introduction

History and features of Go – setting up the Go environment using the Go Playground and VS Code – introduction to Go modules and dependency management – writing the first Go program – understanding Go's program structure and syntax – data types including integers, floating-point numbers, strings, and Booleans.

UNIT II – Basics of Go

Variables and constants – operators and type conversions – naming conventions and scope rules – control flow statements such as if, switch, and loop constructs – introduction to arrays and slices – usage of built-in functions including append, copy, len, and cap – understanding maps and their practical applications.

UNIT III – Functions, Error Handling and Packages

Function definitions with parameters and return values – variadic functions – recursion and closures – error handling using the error interface – use of defer, panic, and recover for managing exceptional scenarios – introduction to pointers with * and & operators – importing and creating custom packages – modular code design and package reusability – writing test functions using the testing package, table-driven tests,benchmarks.

UNIT IV – Structs, Interfaces and Concurrency

Working with structs and associated methods – defining and accessing struct fields – implementing embedded types – understanding interfaces and polymorphism in Go – Type switch and type assertion – defining and using generic types and functions – exploring pointers in-depth – introduction to concurrency using goroutines and channels – buffered and unbuffered channels – channel direction – select statement – context management and cancellation signals.\

UNIT V – File Handling, Web Development and Microservices

File and folder operations – reading from and writing to files – building web servers using the net/http package – handling requests and responses – creating RESTful APIs using routers like Mux or Gin – encoding and decoding JSON – introduction to microservices architecture – creating modular services in Go – inter-service communication via REST and gRPC – basic service discovery and load balancing concepts.

Text Books

1. Alan A. A. Donovan and Brian W. Kernighan – *The Go Programming Language* – Addison-Wesley Professional,2015.
2. William Kennedy and Brian Ketelsen and Erik St. Martin – Go in Action – Manning Publications,2015.

Reference Book

1. Mihalis Tsoukalos – Mastering Go: Create Golang Production Applications using Network Libraries, Concurrency and Advanced Go Data Structures,Packt Publishing,2019.

Course Outcomes:

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

CO1	To understand, impart and analyze the concepts and of Go programming	K1-K6
CO2	To understanding of variables, control structures, functions, and packages.	
CO3	To implemented concurrent programming using go routines and channels	
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	
CO5	To understand modern development practices and tools.	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE105: DOT NET TECHNOLOGIES	L	P	C
I		3	0	3

Course Objectives

- To explore the backbone of web page creation by developing .NET skill.
- To Familiar with Application, session and view state management
- To Provide depth knowledge about ADO.NET
- To Understand the need of usability, evaluation methods for web services
- To acquire knowledge on the usage of recent platforms in developing web applications

Unit – 1 - The .NET Framework - Learning the .NET languages - Introduction - Net revolution - .Net framework and its architecture – CLR – What is Assembly – Components of Assembly – DLL hell and Assembly Versioning- O Objects and Namespaces - Setting Up ASP.NET and IIS.

Unit – II - Developing VB.NET Applications - Introduction to VB.Net, The .Net Frame work and Common language runtime, Building VB. Net Application, VB IDE, forms, properties, events, VB language-console application and 46 windows application, data type, declaring variable, scope of variable, operators and statements - Windows Applications-forms, adding controls to forms, handling events, MsgBox, Input Box, multiple forms, handling mouse and Keyboard events, object oriented programming creating and using classes and objects, Handling Exceptions- on Error Goto.

Unit – III - Developing - ASP.NET Applications - ASP.NET Applications – Understanding ASP.NET Controls - Overview of ASP.NET framework, Web Form fundamentals - Web control classes – Using Visual Stdio.NET - Validation and Rich Controls -State management – Tracing, Logging, and Error Handling.

Unit – IV - Developing C#.NET Applications - Introducing C# - overview of C# - Literals,Variables- Data Types, -Operators, -checked and unchecked operators – Expressions – Branching -Looping-*Object Oriented Aspects Of C#:* Class – Objects - Constructors and its types-inheritance, properties, indexers, index overloading – polymorphism - sealed class and methods - interface, - abstract class, operator overloading, - delegates, events, errors and exception - Threading.

Unit – V - ADO.NET - Overview of ADO.NET - ADO.NET data access – Connected and Disconnected Database, Create Connection using ADO.NET Object Model, Connection Class, Command Class Data binding – Data list – Data grid – Repeater – Files, Streams and Email – Using XML.

Text Books

1. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2016.
   Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2017.
2. ASP.NET Unleashed, C# programming – Wrox publication,2015.
3. Visual Basic. NET Black Book, by Steven Holzner,2017.

Reference Books

1. Jesse Liberty , 'Programming C#, " , 4th Edition, O'Reilly Media,2011.
2. Mario Szpuszta, Matthew MacDonald , "Pro ASP.NET 4 in C#: Includes Silverlight", Third Edition, Apress,2016.

Course Outcomes:

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

CO1	To understand the concepts of .NET framework and its architecture.	K1-K6
CO2	To understanding of VB.NET IDE, forms, properties, events and windows form	
CO3	To implemented the ASP.NET web application.	
CO4	To understand the C# variables, control structures, functions, and packages	
CO5	To understand database connectivity using ADO.NET	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE204: MACHINE LEARNING	L	P	C
II		3	0	3

Course Objectives:

- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT I – INTRODUCTION AND MATHEMATICAL FOUNDATIONS

Machine Learning: Need –History – Definitions – Applications - Advantages, Disadvantages & Challenges - Types of Machine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry - Probability and Statistics- Bayesian Conditional Probability-Vector Calculus & Optimization - Decision Theory - Information theory

UNIT II – SUPERVISED LEARNING

Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms

UNIT III – UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning.

UNIT IV – PROBABILISTIC METHODS FOR LEARNING

Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks - Probabilistic Modelling of Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models

UNIT V – NEURAL NETWORKS AND DEEP LEARNING

Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases.

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	
CO3	To understand, use and perform evaluation of Regression methods	
CO4	To recognize, implement and analyse the unsupervised techniques for real-world applications	
CO5	To understand, identify, implement and review the deep learning techniques for real-time applications	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE204: COMPUTER VISION	L	P	C
II		3	0	3

Course Objectives:

- To understand the concepts and foundations of computer vision
- To explore the different image filtering operations and methods
- To learn different aspects of Thresholding techniques
- To learn the role of Thresholding techniques and segmentation methods
- To understand the basic concepts of Supervised and Unsupervised Learning.

Unit I

Fundamental of Computer Vision: Introduction to Computer Vision - Nature of Vision- The Process of Recognition - Tackling the Recognition problem, Object Location- Scene Analysis.

Low Level Vision: Images and Imaging Operations: Gray scale Vs Color; Image Processing Operations: Basic operations on Gray Scale images, Basic operations on Binary images, Convolutions and Point spread functions.

Unit II

Image Filtering Operations: Noise Suppression by Gaussian Smoothing- Median filters- Mode Filters – Rank Order Filters – Sharp and Unsharp Masking - Color in Image Filtering.

Corner and Interest point detection: Template Matching, Second order derivative schemes – Median filter based Corner detectior – Harris interest point operator – Corner orientation –SIFT operator – SURF operator.

Edge Detection: Basic Theory of Edge Detection – Template matching Approach – Canny Operator – Laplacian operator – Active Contours.

Unit III

Thresholding Techniques: Region Growing Methods – Adaptive Thresholding – Local Thresholding methods –Variance Based Thresholding – Entropy Based Thresholding.

Segmentation: Active contours, Split and merge: Watershed, Region splitting, Region merging, Graph based segmentation; Mean shift, Normalized cut, Graph cuts.

Unit IV

Mathematical Morphology: Dilation and Erosion in binary Images – Properties of Dilation and Erosion – Closing and Opening – Gray scale Processing: Morphological Edge Enhancement.

Texure: Basic Approaches to Texture Analysis – Gray level Co-occurance Matrices – Laws and Ade Approaches.

Binary Shape Analysis: Size Filtering – Skeletons and Thinning – Measures for shape Recognition – Boundary tracking.

Video Processing: Introduction- Principles of Color Video processing - Video display - Basics of background modeling and Foreground detection - Connected Components labeling.

Unit V

Statistical Pattern Recognition: Introduction – Nearest Neighbor Algorithm – Bayes Decision Theory – Multiple Classifiers – Cluster Analysis – Supervised and Unsupervised Learning – Principal

Components Analysis(PCA) – Support Vector Machine- Artificial Neural Networks- Back Propagation Algorithm.

Text Books

1. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
2. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010.
3. D. Forsyth, J.Ponce, "Computer Vision- A Modern Approach" Second edition, Pearson Publication, 2013.

Reference Books

1. Milan Sonka, Vaclav Hlavac, and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Fourth Edition,Cengage Learning,2015.
2. Simon J. D. Prince, " Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.
3. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing",Pearson,Education, Inc., Fourth Edition, 2018.

Course Outcomes

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

CO1	To understand the concept of Computer vision	K1-K6
CO2	To implement the image filter operation and edge detection	
CO3	To understand thresholding techniques and segmentation methods	
CO4	To implement the morphology operations and understand the video processing	
CO5	To understand basic concepts of Supervised and Unsupervised Learning.	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE205: GRID COMPUTING	L	P	C
II		3	0	3

Course Objectives:

- To provide in-depth knowledge in computing techniques with grid as the platform.
- To know the concepts pertaining to grid computing environment and also designing trusted grid computing system.
- To understand various techniques to enhance the performance and scalability of data management and knowledge oriented grids.
- To understand the components of Globus Toolkit 3 Architecture and Security Infrastructures for the Grid.
- To nurture the students to apply Grid Technology for the market scenarios
-

UNIT I INTRODUCTION

Parallel and Distributed Computing - Cluster Computing - Grid Computing Anatomy and Physiology of Grid -Web and Grid Services.

UNIT II FRAMWORK

Architecture – Implementation of Grid Architecture – Grid Services OGSI, OGSA, WSRF –Grid Resource and Service Management –Resource Management Framework – Service Negotiation and Acquisition Protocol – Layers of Grid Computing – Building Reliable Services - Grid Monitoring – Sensors and Sensor Management - Grid Security – WS Security – GSI.

UNIT III DATA AND KNOWLEDGE GRID

Data Source – Collective Data Services - Data Management – Collective Data Management – Federation Services – Representing Knowledge – Processing Knowledge - Knowledge Oriented Grid

UNIT IV GRID MIDDLEWARE

List of Globally Available Toolkits – GT3 – Architecture Details – Grid Service Container – OGSI Implementation – Security Infrastructure - System Level Services – Hosting Environments Programming

UNIT V APPLICATIONS

Scientific – Medical – Bioinformatics – Federated Computing – ERM – Multiplayer Games – Collaborative Science – Grid Computing for SAS, Case Study.

Text Book:

1. Ian Foster, Carl Kesselman, “The Grid 2: Blueprint for a New Computing Infrastructure”, Elsevier Series, Second edition, 2014.

Reference Book:

1. Lizhe Wang,"Grid Computing: Infrastructure, Service, and Applications ",CRC Press,2017.

Course Outcomes

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

CO1	To understand, impart and analyze the concepts and of grid computing	K1-K6
CO2	To understand various techniques to enhance the performance and scalability of data management	
CO3	To understand data services and use of knowledge Oriented Grid	
CO4	To recognize, implement and analyse OGSI Hosting Environments Programming	
CO5	To understand, identify the Medical and Bioinformatics techniques for real-time applications	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE205: NATURAL LANGUAGE PROCESSING	L	P	C
II		3	0	3

COURSE OBJECTIVES:

- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots.

UNIT I – INTRODUCTION

Natural Language Processing, Components, Basics of Linguistics and Probability and Statistics, Words, Tokenization, Morphology, Finite State Automata

UNIT II – STATISTICAL NLP AND SEQUENCE LABELING

N-grams and Language Models, Smoothing, Text Classification, Naïve Bayes Classifier, Evaluation, Vector Semantics, TF-IDF, Word2Vec, Evaluating Vector Models, Sequence Labeling, Part of Speech, Part of Speech Tagging, Named Entities, Named Entity Tagging

UNIT III – CONTEXTUAL EMBEDDING

Constituency, Context Free Grammar, Lexicalized Grammars, CKY Parsing, Earley's Algorithm, Evaluating Parsers, Partial Parsing, Dependency Relations, Dependency Parsing, Transition Based, Graph Based

UNIT IV – COMPUTATIONAL SEMANTICS

Word Senses and WordNet, Word Sense Disambiguation, Semantic Role Labeling, Proposition Bank, FrameNet, Selectional Restrictions, Information Extraction, Template Filling

UNIT V – DISCOURSE ANALYSIS AND SPEECH PROCESSING

Discourse Coherence, Discourse Structure Parsing, Centering and Entity-Based Coherence, Question Answering, Factoid Question Answering, Classical QA Models, Chatbots and Dialogue Systems, Frame-Based Dialogue Systems, Dialogue–State Architecture

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*, Prentice Hall Series in Artificial Intelligence, 2020

2. Jacob Eisenstein, *Natural Language Processing*, MIT Press, 2019
3. Samuel Burns, *Natural Language Processing: A Quick Introduction to NLP with Python and NLTK*, 2019

REFERENCE BOOKSS:

1. Deepti Chopra and Nisheeth Joshi, *Mastering Natural Language Processing with Python*, Packt Publishing Limited, 2016
2. Mohamed Zakaria Kurdi, *Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)*, ISTE Ltd., 2016
3. Atefeh Farzindar and Diana Inkpen, *Natural Language Processing for Social Media (Synthesis Lectures on Human Language Technologies)*, Morgan and Claypool Life Sciences, 2015.

COURSE OUTCOMES:

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

CO1	Understand basics of linguistics, probability, and statistics associated with NLP	K1-K6
CO2	Implement a Part of Speech Tagger	
CO3	Design and implement a sequence labeling problem for a given domain	
CO4	Implement semantic processing tasks and a simple document indexing and searching system using the concepts of NLP	
CO5	Implement a simple chatbot using dialogue system concepts	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE205: INTERNET OF THINGS(IoT)	L	P	C
II		3	0	3

COURSE OBJECTIVES:

- About Internet of Things where various communicating entities are controlled and managed for decision making in the application domain.
- Enable students to learn the Architecture of IoT and IoT Technologies
- Developing IoT applications and Security in IoT, Basic Electronics for IoT, Arduino IDE,Sensors and Actuators Programming NODEMCU using Arduino IDE.

Unit-I INTRODUCTION

Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT

Unit-II BASIC ELECTRONICS FOR IoT

Basic Electronics for IoT: Electric Charge, Resistance, Current and Voltage – Binary Calculations – Logic Chips – Microcontrollers – Multipurpose Computers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation.

Unit-III ARDUINO

Programming Fundamentals with C using Arduino IDE: Installing and Setting up the Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.

Unit-IV SENSORS AND ACTUATORS

Sensors and Actuators: Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.

Unit-V SENSOR IN INTERNETs

Sending Sensor Data Over Internet: Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform (ThingSpeak)

Text Books

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, 2014.
2. Boris Adryan, DominikObermaier, Paul Fremantle, “The Technical Foundations of IoT”, Artech Houser Publishers, 2017.

Reference Books

1. Michael Margolis, “Arduino Cookbook”, O“Reilly, 201.1
2. Marco Schwartz, “Internet of Things with ESP8266”, Packt Publishing, 2016.
3. DhivyaBala, “ESP8266: Step by Step Tutorial for ESP8266 IoT, Arduino NODEMCU Dev. Kit”, 2018.

COURSE OUTCOMES:

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

CO1	Understand basics of IoT and IoT development applications	**K1-K6**
CO2	To learn the basic electronics for IoT and Electronic Signals.	
CO3	Implement the C programming using Arduino IDE	
CO4	Understand the Sensors and Actuator in Arduino	
CO5	Implement the NODEMCU Programms using Arduino IDE	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE204: DEEP AND REINFORCEMENT LEARNING	L	P	C
II		3	0	3

UNIT I: Deep Learning Concepts

Fundamentals of Deep Learning – Perceptron Learning Algorithms – Probabilistic Modelling – Early Neural Networks – How Deep Learning Differs from Machine Learning – Scalars, Vectors, Matrices, and Higher Dimensional Tensors – Manipulating Tensors – Vector Data – Time Series Data – Image Data – Video Data.

UNIT II: Neural Networks

Introduction to Neural Networks – Building Blocks of Neural Networks – Optimizers – Activation Functions – Loss Functions – Data Pre-processing for Neural Networks – Feature Engineering – Overfitting and Underfitting – Hyperparameters.

UNIT III: Convolutional Neural Networks (CNN)

Introduction to CNN – Linear Time Invariant Systems – Image Processing and Filtering – Building a Convolutional Neural Network – Input Layers – Convolution Layers – Pooling Layers – Dense Layers – Backpropagation Through Convolution and Pooling Layers – Filters and Feature Maps – Dropout Layers and Regularization – Batch Normalization – Various Activation Functions – Various Optimizers – CNN Architectures: LeNet, AlexNet, VGG16, ResNet – Transfer Learning with Image Data – Transfer Learning using Inception (Oxford VGG Model), Google Inception Model, Microsoft ResNet Model – Object Detection Models: R-CNN, Fast R-CNN, Faster R-CNN, Mask R-CNN, YOLO.

UNIT IV: Natural Language Processing Using RNN

Introduction to NLP and its Toolkits – Language Modeling – Vector Space Model (VSM) – Continuous Bag of Words (CBOW) – Skip-Gram Model for Word Embedding – Part-of-Speech (PoS) Tagging – Global Co-occurrence Statistics–Based Word Vectors – Transfer Learning – Word Embeddings: Word2Vec, GloVe – Backpropagation Through Time – Recurrent Neural Network Variants: Bidirectional RNNs (BRNN), Long Short-Term Memory (LSTM), Bi-directional LSTM – Sequence-to-Sequence Models (Seq2Seq) – Gated Recurrent Unit (GRU).

UNIT V: Deep Reinforcement and Unsupervised Learning

Introduction to Deep Reinforcement Learning – Q-Learning – Deep Q-Network (DQN) – Policy Gradient Methods – Actor-Critic Algorithm – Introduction to Autoencoding – Convolutional Autoencoders – Variational Autoencoders – Generative Adversarial Networks (GANs) – Autoencoders

for Feature Extraction – Autoencoders for Classification – Denoising Autoencoders – Sparse Autoencoders.

Text Books

1. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
2. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020

Reference Books

3. Deep Learning: A Practitioner's Approach, Josh Patterson and Adam Gibson, O'Reilly Media, Inc., 2017
4. Deep Learning with Python, François Chollet, Manning Publications, 2017.
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017.

Course Outcomes:

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

CO1	Understand basics of concepts of deep learning	**K1-K6**
CO2	To learn the Neural Networks concepts and different kinds of methodology	
CO3	Understand the Convolutional Neural Network and Various Activation Functions.	
CO4	Implement semantic processing tasks and a simple document indexing and searching system using the concepts of NLP	
CO5	To Learn the Deep Reinforcement Learning and Generative Adversarial Networks.	

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

S-Strong; M-Medium; L-Low

Semester	25MCAE304: CLOUD COMPUTING	L	P	C
III		3	0	3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I: CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud Deployment Models – Cloud Service Models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II: VIRTUALIZATION BASICS

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization Structure – Implementation Levels of Virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory, and I/O Devices

UNIT III: VIRTUALIZATION INFRASTRUCTURE AND DOCKER

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level Operating Virtualization – Application Virtualization – Virtual Clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Containers – Docker Images and Repositories

UNIT IV: CLOUD DEPLOYMENT ENVIRONMENT

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack

UNIT V: CLOUD SECURITY

Virtualization System-Specific Attacks: Guest Hopping – VM Migration Attack – Hyperjacking. Data Security and Storage; Identity and Access Management (IAM) – IAM Challenges – IAM Architecture and Practice

Text Books

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing: From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.

2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3. Krutz, R.L., Vines, R.D., “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

Reference Books

1. SK Singh, Dr. Vimal Mishra, Dr. A.K. Dubey and Aditya Bhushan,"Mastering Cloud Computing",KnoDAX,2024.
2. Anders Lisdorf ,"Cloud Computing Basics: A Non-Technical Introduction",I st edition,Apress,2021.

Course Outcomes

After successful completion, students will be able to:

CO1	Understand the terminology and concepts of the Cloud computing	K1-K6
CO2	Student will get the knowledge of Virtualization and virtual machine	
CO3	Gain the knowledge of Dockers	
CO4	Familiar with Amazon AWS and cloud software environments	
CO5	Understand the cloud security and IAM	

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

L-Low,M-Medium,S-Strong

Semester	25MCAE304: BIO INSPIRED LEARNING	L	P	C
III		3	0	3

COURSE OBJECTIVES:

- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing
- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in various fields

UNIT I INTRODUCTION

Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature Inspired Algorithms –Parameter tuning and parameter control

UNIT II RANDOM WALK AND ANNEALING

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains – step sizes and search efficiency - Modality and intermittent search strategy - importance of Randomization - Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling

UNIT III GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection

UNIT V APPLICATIONS OF BIO INSPIRED COMPUTING

Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search- Bio inspired algorithms in cloud computing- Wireless Sensor Networks using Bio inspired Algorithms

Text Books

1. Eiben,A.E.Smith,James E, "Introduction to Evolutionary Computing",Second Edition, Springer 2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", First Edition, Intech,2013
3. Xin-She Yang , Joao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",First Edition, Elsevier,2016.

Reference Books

1. Xin-She Yang, "Nature Inspired Optimization Algorithm", First Edition, Elsevier, 2014
2. Yang ,Cui,XIao,Gandomi,Karamanoglu,"Swarm Intelligence and Bio-Inspired Computing", First Edition, Elsevier 2013.

Course Outcomes

After successful completion, students will be able to:

CO1	To understand the bio-inspired concepts and algorithms	K1-K6
CO2	Student will get the knowledge of random walks and boltzmann distribution concepts	
CO3	Gain the knowledge of genetic algorithms and differential evolution	
CO4	Familiar with Swarm intelligence and Firefly algorithm	
CO5	Understand the Application of Wireless Sensor Networks using Bio inspired 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	S	S	M	S	M	S	M	M	M
CO2	S	S	M	M	M	M	S	M	S	L
CO3	M	M	M	L	L	L	L	M	M	M
CO4	S	M	M	S	L	S	M	L	S	M
CO5	S	S	S	M	L	L	S	L	M	L

L-Low,M-Medium,S-Strong

Semester	25MCAE304:GENERATIVE AI	L	P	C
III		3	0	3

COURSE OBJECTIVES:

- To understand the principles used in Generative AI
- To explore Knowledge about OpenAI.
- To acquire knowledge in prompt design.
- To improve writing skills using ChatGPT.
- To study the translation among different languages.

UNIT – I FUNDAMENTALS OF GENERATIVE AI AND GPT MODELS

Introduction To Generative AI - Domains Of Generative AI - Text Generation - Image Generation - Music Generation - Video Generation - The History And Current Status Of Research - OpenAI And ChatGPT-Beyond The Market Hype: - Technical Requirements - What Is OpenAI? - An Overview Of ChatGPT: The Math Of The Model Behind It - The Structure Of RNNs - The Main Limitations Of RNNs -Overcoming Limitations-Introducing Transformers GPT-3 - ChatGPT: The State Of The Art.

UNIT – II CHATGPT IN ACTION - GETTING FAMILIAR WITH CHATGPT

Setting up a ChatGPT Account – Familiarizing Yourself With The UI – Organizing Chats - Understanding Prompt Design: What is a Prompt and Why is it Important? – Zero-, One-, And Few-Shot Learning - Typical of Transformers Models – Principles of Well-Defined Prompts to obtain Relevant and Consistent Results – Avoiding The Risk of Hidden Bias And Taking Into Account Ethical Considerations in ChatGPT.

UNIT - III BOOSTING DAY-TO-DAY PRODUCTIVITY WITH CHATGPT

Technical Requirements – ChatGPT as a Daily Assistant – Generating Text – Improving Writing Skills And Translation – Quick Information Retrieval and Competitive Intelligence - Developing The Future With ChatGPT - Why ChatGPT For Developers? – Generating, Optimizing, And Debugging Code – Generating Documentation And Code Explainability – Understanding Ml Model Interpretability – Translation Among Different Programming Languages.

UNIT – IV MASTERING MARKETING AND RESEARCH WITH CHATGPT

Technical Requirements – Marketers' Need For ChatGPT – New Product Development And The Go-To-Market Strategy – A/B Testing For Marketing Comparison – Boosting Search Engine Optimization (seo) – Sentiment Analysis To Improve Quality And Increase Customer Satisfaction - Research Reinvented With ChatGPT: Researcher's Need For ChatGPT – Brainstorming Literature For Your Study – Providing Support For The Design And Framework of Your Experiment – Generating And Formatting A Bibliography – Generating A Presentation Of The Study.

UNIT – V OPENAI FOR ENTERPRISES

OpenAI And ChatGPT For Enterprises-Introducing Azure OpenAI: Technical Requirements – OpenAI And Microsoft For Enterprise-Level AI – Introducing Azure OpenAI: Microsoft AI

Background – Azure OpenAI Service – Exploring Playground Why Introduce A Public Cloud? – Understanding Responsible AI – Microsoft's Journey Towards Responsible AI – Azure OpenAI And Responsible AI - Trending Use Cases For Enterprises: Technical Requirements – How Azure OpenAI Is Being Used In Enterprises – Contract Analyzer And Generator– Understanding Call Center Analytics – Exploring Semantic Search.

TEXT BOOK

1. Valentina Alto, "Modern Generative AI with ChatGPT and OpenAI Models" , Packt Publishing, 2023.

REFERENCE BOOKS

1. Raghav Bali, Generative AI with Python and TensorFlow2, 2021.
2. Mohak Agarwal, "Generative AI for Entrepreneurs in a Hurry", 2023.

Course Outcomes

After successful completion, students will be able to:

CO1	To understand the fundamentals of generative ai and gpt models	K1-K6
CO2	Student familiar with chatgpt account and Prompt Design	
CO3	Gain the knowledge of Ml Model Interpretability	
CO4	Familiar with Research Reinvented With ChatGPT	
CO5	Understand the Open ai For Enterprises	

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

L-Low,M-Medium,S-Strong

Semester	25MCAE305:CYBER SECURITY	L	P	C
III		3	0	3

OBJECTIVES:

- To learn the principles of cyber security and to identify threats and risks.
- To learn how to secure physical assets and develop system security controls.
- To understand how to apply security for Business applications and Network
- Communications.
- To learn the technical means to achieve security.
- To learn to monitor and audit security measures.

UNIT- I PLANNING FOR CYBER SECURITY

Best Practices-Standards and a plan of Action-Security Governance Principles, components andApproach-Information Risk Management-Asset Identification-Threat Identification-VulnerabilityIdentification-Risk Assessment Approaches-Likelihood and Impact Assessment-RiskTentativeDetermination, Evaluation and Treatment-Security Management Function-Security Policy-Acceptable Use Policy-Security Management Best Practices - Security Models: Bell La Padulamodel, Biba Integrity Model -Chinese Wall model

UNIT- II SECURITY CONTROLS

People Management-Human Resource Security-Security Awareness and Education-InformationManagement- Information Classification and handling-Privacy-Documents and RecordManagement-Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC - Disaster management and Incident response planning.

UNIT- III CYBER SECURITY FOR BUSINESS APPLICATIONS ANDNETWORKS

Business Application Management-Corporate Business Application Security-End user DevelopedApplications-System Access- Authentication Mechanisms-Access Control-System Management-Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security-Electronic Communications - Case study on OWASP vulnerabilities using OWASP ZAP tool.

UNIT-VI TECHNICAL SECURITY

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-IntrusionDetection-Digital Rights Management-Cryptographic Techniques-Threat and IncidentManagement-Vulnerability Management-Security Event Management-Forensic Investigations- Local Environment Management-Business Continuity.

UNIT- V SECURITY ASSESSMENT

Security Monitoring and Improvement-Security Audit-Security Performance-Information RiskReporting-Information Security Compliance Monitoring-Security Monitoring and ImprovementBest Practices.

Text Books

1. William Stallings, "Effective Cyber Security - A guide to using Best Practices and Standards", Addison-Wesley Professional, First Edition, 2019.
2. Adam Shostack, "Threat Modelling - Designing for Security", Wiley Publications, FirstEdition, 2014.
3. Gregory J. Touhill and C. Joseph Touhill, "Cyber Security for Executives - A PracticalGuide", Wiley Publications, First Edition, 2014.

Reference Books

1. Raef Meeuwisse, "Cyber Security for Beginners", Second Edition, Cyber Simplicity Ltd,2017.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hackingand Penetration Testing Made Easy", 2nd Edition, Syngress, 2013.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, "Security inComputing", Fifth Edition, Prentice Hall, 2015

Course Outcomes

After successful completion, students will be able to:

CO1	Understand the principles of cyber security and threats	K1-K5
CO2	Student will get the knowledge of to secure physical assets and develop system security controls	
CO3	Familiar with Business applications and Network Communications.	
CO4	Understand the Technical security Measures.	
CO5	Study the cyber security software and tools for monitoring and improve the 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	M	M	M	S	S	M	M
CO2	S	M	M	M	M	M	M	M	S	L
CO3	S	M	M	L	L	L	L	M	M	M
CO4	S	S	M	S	M	M	M	L	L	M
CO5	S	S	S	S	L	L	S	M	M	L

L-Low,M-Medium,S-Strong

Semester	25MCAE305: CRYPTO CURRENCY AND BLOCK CHAIN TECHNOLOGIES	L	P	C
III		3	0	3

COURSE OBJECTIVES:

- To understand the basics of Blockchain
- To understand the basics of Cryptocurrency
- To understand the working of digital tokens and wallets
- To understand the working of contracts
- To understand the working of block chain platforms
-

UNIT I OVERVIEW OF BLOCKCHAIN

Why Blockchain - The Structure of Blockchain - Data Structure of Blockchain - Data Distribution in Blockchain - Block Validation. Block Validators: Consensus - Proof of Work – Proof of Stake - Proof of Activity - Proof of Elapsed Time - Proof of Burn

UNIT II CRYPTOCURRENCY

Bitcoin: Bitcoin Working - Bitcoin Transactions - Bitcoin Mining - Value of Bitcoin - Community, Politics and Regulations – Advantages – Disadvantages. Ethereum: Overview – Decentralized Application. Components of Ethereum: Smart contracts – Ether - Ethereum Clients – Ethereum Virtual Machine – Etherscripter

UNIT III DEVELOPMENT FRAMEWORKS

Digital Tokens: Overview - Initial Coin Offering – OmiseGO – EOS – Tether. Meta Mask: Wallet Seed – Meta Mask Transactions. Mist: Overview - Mist wallet. Truffle: Features of Truffle – Development Truffle boxes - Community truffle box.

UNITI IV

HYPERLEDGER :Hyperledger Fabric: Introduction - Fabric v/s Ethereum – Hyperledger Iroha - Features of Iroha. Hyperledger Sawtooth: Components of sawtooth - Proof of Elapsed time.

UNIT V BLOCKCHAIN PLATFORMS: Multichain - HydraChain. Future Blockchain: IOTA – Corda - Chain Core.Blockchain Framework: CoCo Framework – Tierion – BigchainDB

Text Books

1. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guide to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. 1st Edition, Princeton University Press, 2016.

Reference Books

1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.
2. Antony Lewis, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Mango Publishing group, 2018.

5. Tiana Laurence, Introduction to Blockchain Technology, 1st Edition, Van Haren Publishing, 2019.

Course Outcomes

After successful completion, students will be able to:

CO1	Understand the basics of Blockchain technologies	K1-K5
CO2	Student will get the knowledge of cryptocurrency with bitcoin	
CO3	Familiar with working of digital tokens and wallets.	
CO4	Understand the Hyperledger Fabric and Sawtooth.	
CO5	Student to study the Blockchain platform	

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

L-Low,M-Medium,S-Strong

Semester	25MCAE305: INTELLIGENT INFORMATION SYSTEM	L	P	C
III		3	0	3

COURSE OBJECTIVES:

The objectives of this subject are to:

• Introduce the principles, concepts, theories, and technologies that are developed in the fields of artificial and computational intelligence.

• Understand how the intelligent techniques can be used in the construction of information systems to support management decision making.

• Enable students to master the techniques for problem solving in various application areas in business and finance, computing and engineering.

Unit-I

Introduction, Data, Information and Knowledge: Architecture of an intelligent information systems; decision making and systems; artificial intelligence techniques, concepts of data and information; methods to process data into information in organizations; transaction processing systems; database and knowledge base management.

Expert Systems for Managers: Introduction to expert systems; knowledge engineering; knowledge acquisition; knowledge representation and inference; uncertainty representation and reasoning; verification and validation applications in business and finance.

Unit-II

Data and Text Mining: Data mining and knowledge discovery life cycle, association, classification, clustering and prediction, soft computing in data mining, text mining, information extraction and retrieval.

Intelligent Decision Support Systems for Business Intelligence: Computational intelligence techniques; geneticalgorithms for organizational modeling; neural networks and fuzzy logic for business applications; hybrid systems;integration of expert systems and neural networks; integrated intelligent systems.

Unit-III

Fuzzy Information Systems: Classical vs. fuzzy sets; membership functions; predicate vs. fuzzy logic; approximate reasoning; natural language; linguistic hedges; rule-based systems; likelihood and truth qualification; graphical techniques of inference.

Unit-IV

Genetic algorithms for management applications: Natural evolution; a simple genetic algorithm; evaluation; population; parent selection; mutation; crossover; the inversion operator; performance enhancement; elitism; steady-state reproduction; robustness; interpolating operator fitness; applications in business, finance and management.

Unit-V

Neural Computation for business and finance: Biological vs. artificial neural networks; single- and multiple-layer perceptron; the learning rules; partition of pattern space; back- propagation; Kohonen Self-Organizing Networks; Hopfield Networks; supervised and unsupervised learning; associative memories.

Text Books

1. Pal, S.K., and Shiu, S.C.K., Foundations of Soft Case-Based Reasoning, John Wiley & Sons, Hoboken, New Jersy, 2010.
2. Liebowitx, J., Knowledge Management: Learning from Knowledge Engineering, CRC Press, Boca Raton, FL,2010

Reference Books:

1. Bojadziev, G., and Bojadziev. M., Fuzzy Logic for Business, Finance and Management, World Scientific, Singapore. 2017.
2. Miller, T.W., Data and Text mining: A Business Application Approach, Prentice Hal,2015.

Course Outcomes

After successful completion, students will be able to:

CO1	Understand the principles of artificial and computational intelligence	K1-K5
CO2	Student will get the knowledge of Data and Text Mining	
CO3	Familiar with Fuzzy Information Systems.	
CO4	Understand the Biological vs. artificial neural networks.	
CO5	Student will get the knowledge of Neural Computation for business and finance	

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

L-Low,M-Medium,S-Strong